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Table of Contents

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Dear IEJEE readers,

After publishing the special issue of International Electronic Journal of Elementary Education (IEJEE) on *Out of School Education*, edited by guest editors Dr. Christian W. BECK of University of Oslo and Dr. Thomas Spiegel of Friendensau University, we received an overwhelming positive response. It's always ecouraging to see that IEJEE steady increase its circle of readers. We are also proud of the content of this volume.

Dr. Meredith PARK ROGERS of Indiana University, Bloomington Indiana, USA, presents promising results and ideas from her study on the role of collaborative teaching approach, which also refers to as a community of practice (CoP), on the involved teachers' implematation of a science-based interdisiplinary curriculum. Dr. Park Rogers used multi-method approach to highlight an alternative approach to and positive results from science teaching at the elemantary education. Drawing on several studies done by well known researchers in the field of teaching, learning and curriculum development, she presents an exceptionally informative theory-based and practice guiding article.

Dr. Rhonda JOY of Memorial University of Newfoundland and Labrador, Newfoundland, Canada, adresses an important topic withing the field of Bilingual Research. As many of us are aware of, the number of children who grow up with at least two languages is growing rapidly in our multicultural and multilingual world. Her research on the concurrent development of spelling skills in two languages will be an important contribution to the field. Her findings will enhence our existing understanding of the elements of the common underlying proficiency for dual language development as this was hypothesized by Dr. Jim Cummins. As a researcher in the field of bilingualism and bilingual education, I look forward to quote her findings about spelling in two languages in my future discussions of the relationship between the bilingual children's first and second language.

Teacher Education is an important institution in all countries. Specially teacher education which prepares teacher candidates to work in linguistically and culturally diverse schools is of atmost importance. Increasing diversity in many school systems is a rule rather than exception in

ISSN:1307-9298

our time. *Dr. George ZHOU* of University of Windsor, Canada, *Dr. Jinyoung KIM* and *Dr. Judit KEREKES* of The City University of New York, USA, adress the importance of collaborative teaching in a teacher education program. It's a sound approach to educate teachers through collaborative teaching since we are interested in having teachers who can teach collaborativly in our schools. Their well wrietten paper strenghtens our belief in the feasibility of collaborative teaching at our teacher education programs. At the same time their findings indicate that this approach also beneficial to both teacher educators and teacher candidates.

Dr. Ahmet BAYTAK of Harran University, Şanlıurfa, Turkey, *Dr. Bülent TARMAN* of Selçuk University, Konya, Turkey and *Dr. Cemalettin AYAS* of Sinop University, Sinop, Turkey, take up an contemporary topic: Children's perceptions of their own learning experiences with the use of technological equipments and Internet technologies. As the authors state, many studies focus on integration of technology in teaching-learning activities at school and home. Investigating the students' experiences and their perceptions of intagration of the mentioned technologies in learning activites, however, has not yet been given enough attention. In their well written paper, the authors present their small-scale research from an American context. Based on their multi-sourced data, the researchers put their fingers on the discrepancies between the established beliefs and realities with regard to the integration of technologies in the children's teaching-learning activities at school and home.

I want to take the opportunity to thank *Dr. Turan Temur* of University of Dumlipinar and *Dr. Gökhan Özsoy* of Aksaray University for their editorial contributions. I also want to express my gratitude to all of the peer reviewers for this volume.

I am certain that as a reader you'll enjoy the four papers in this issue of IEJEE.

Sincerely,
Dr. Kamil Özerk, Editor-In-Chief
Professor of Education
University of Oslo

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Implementing a science-based interdisciplinary curriculum in the second grade: A community of practice in action*

Meredith PARK ROGERS**
Indiana University, Bloomington Indiana, United States

Abstract

The purpose of this study was to explore the role that a collaborative teaching approach, referred to as a community of practice (CoP), had on a team of four second grade teachers' implementation of a science-based interdisciplinary curriculum. Data was collected in the form of extensive observation notes gathered over 10-weeks of twice weekly team meetings and two 45 minute interviews with each participant. From the field notes developed two vignettes for the purpose of illustrating the members CoP in action. Combining my analysis of the vignettes and the interviews resulted in three emergent themes: 1) benefits, 2) contributions, and 3) their commitment to professional development. From this study I learned that establishing a CoP was viewed as a necessary component of the team's implementation of their science-based interdisciplinary curriculum. Implications for encouraging preservice and inservice elementary teachers to develop CoPs to support science teaching, specifically interdisciplinary teaching, are discussed.

Keywords: elementary education; science; community of practice; interdisciplinary teaching

Introduction

Elementary teachers' avoiding the teaching of science is not a new issue. Tilgner (1990) commented that the situation had not changed in 20 years, and in the decade since, there have been continuing reports along similar lines across the world" (as cited in Appleton, 2007, p. 496). Reports such as *Taking Science to school: Learning and teaching science in grades K-8*

* This manuscript is from a dissertation study and was also presented at the 2007 National Association for Research in Science Teaching.

** Correspondence: Dr. Meredith Park Rogers, W. W. Wright Education Building 201 North Rose Avenue Bloomington, Indiana 47405-1006 812-856-8168 Email: mparkrog@indiana.edu

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(Duschl, Schweingruber & Shouse, 2007) and several Project 2061 publications American Association for the Advancement of Science, 1993) (Rutherford & Ahlgren, 1990; describe the need for consistent science learning in the elementary grades to begin develop students' scientific literacy. Yet, the problem remains, science is considered a second class subject in most elementary classrooms (Roden, 2000).

Some researchers have suggested that to promote the importance of elementary science, studies need to be conducted that examine different approaches elementary teachers use to teach science, such as an integrated curriculum (Raizen & Michelsohn, 1994; Roden, 2000; Tilgner, 1990) or collaborative teaching (Silva, 2000; Supovitz, 2002). It is both of these approaches that serve as the rationale for this study. Through extensive observations and discussions with a team of four second grade teachers, I have developed vignettes to illustrate their community of practice (Lave & Wenger, 1991; Wenger, 1998) and to understand the role their community served them in using science as an organizer for achieving a coherent curriculum. To explore this phenomenon further, the following four questions guided my research process:

1. What does this team's community of practice look like?
2. What role does the community of practice have in implementing their science-based interdisciplinary curriculum?
3. What does the community of practice offer each member with regards to their own professional growth?
4. What are the contributions of each member to the community of practice?

Conceptual Framework

Lave and Wenger's notion of communities of practice (Wenger, 1998) guided my understanding of what it means when groups of people work collaboratively toward a common goal. In this case the goal was to achieve a coherent curriculum using science as an organizer (Park Rogers & Abell, 2006) and what I examined for this study was the inner workings of the team's CoP with respect to how it supported their enactment of this process.

The term "community of practice" (CoP) is grounded in social learning theory, but as Palincsar, Magnusson, Marano, Ford, and Brown (1998) pointed out Lave and Wenger never made any claims about the implications of their studies for constituting communities of practice; in fact they are probably bewildered by the ways in which we and others in education have appropriated their ideas in the service of implementing or developing such communities. However, regardless of Lave and Wenger's intention for introducing the notion of CoP there is a clear connection between its relevance in studying collaborative practices in educational settings in order to better understand teachers' instructional decisions and curricular implementation (Silva, 2000; Palincsar et al., 1998).

As Supovitz (2002) indicated, there are three key components to establishing a successful CoP in an education setting. “First, communities of practice mutually engage on the task at hand. Second, they communally negotiate the contours and focus of their joint enterprise. And third, they develop a set of shared repertoires to effectively address their work” (Supovitz, 2002, p. 1598). Regardless of the amount of time a CoP has been developed or the experience the members of a CoP have, these three components constantly are being refined and honed because each new situation presents new challenges.

Throughout our daily lives we move in and out of various communities that follow specific practices. These CoPs provide the “ideal situated contexts through which implicit and explicit meanings are appropriated and negotiated by members of the community” (Hung, Chee, Hedberg, & Seng, 2005, p. 160). The social networks of a CoP “[form] naturally and are informally bound by the work that people engage in together; they are self-organized, and memberships are based on participation rather than on official status” (Wenger as cited in Foulger, 2005, p. 3). When needed, meanings are negotiated among members based on the assumed understandings of the culture. Therefore, within the structure of a CoP, knowledge is constructed according to the group’s explicit and tacit understandings.

Wesley’s and Buysse’s (2001) comparison of a CoP to that of a learning organization provides support for how the concept of a CoP could be used within a classroom setting. Wesley and Buysse explained that a learning organization “emerges from a common desire among its members to achieve change (i.e., improve existing practices) [and] it provides regular opportunities for collaborative reflection and inquiry through dialogue” (p. 118). Because ongoing reflection and inquiry are also common practices of CoPs it can be said that CoPs can often naturally form within educational settings.

Wenger (1998) referred to participation as the process in which identities are constructed in relation to the community. Thus, the notion of a CoP provided me with a framework to understand each team member’s identity for participation and how their role contributed to the overall dynamics of the team in implementing an inquiry-based curriculum; an approach that was grounded in their beliefs and knowledge of teaching science as inquiry.

Literature Review

There is a growing interest across many education disciplines with using the construct of CoP] (Lave &Wenger, 1991; Wenger, 1998) as a means to study the nature of establishing collaborative experiences in various teaching and learning situations. However, for the most part studies examining CoPs within science education are limited to studying the learning that occurs

through the use of CoPs in research teams (e.g., science laboratories) and professional development contexts (Palincsar et al. 1998). For example, in a research team setting Feldman, Divoll, and Rogan-Klyve (2009) explored characteristics of communities of practice through an apprenticeship experience between graduate and undergraduate studies working on an interdisciplinary scientific research project. What they observed were communities where participants had designated responsibilities thus each member played a pivotal role in the success of the community's scientific practice and ultimately their learning.

Within science education professional development contexts, CoPs are generally used as a method for trying to sustain changes in ideas and practice once teachers return to the classroom (Akerson, Cullen & Hanson, 2009; Lumpe 2007). For example, Akerson et al. (2009) employed the idea of a CoP to support teachers learning about NOS and the transfer of this learning to their instructional practice. What they learned was that "while developing a CoP is not sufficient on its own to improve teachers' views and practice related to NOS, it provides key supports to allow changes in NOS to be continued beyond professional development activities" (p. 22).

In both contexts, the purpose of CoPs was to structure support for learning a new idea and applying that idea to practice (teaching or the lab). Silva (2000) explained however, that educational research needs to move beyond using CoPs simply as a design method, but studying how it can be enacted in a practical sense at the classroom level as a part of teachers' reflective practice.

Manouchehri's study (2001) investigated this idea with two pairs of middle school mathematics teachers. She was interested in understanding what contributions each member of the pair brought to the CoP and how the peers felt their partner's contributions improved their teaching practice. One pair indicated some change in their professional practice after seven months of working together, the other pair did not. Manouchehri learned that an effective CoP requires effort from all members and that perhaps there needs to be some support or guidance during its initial development from an outside source (e.g., a lead teacher or principal). She also suggested the roles participants seem to naturally take on when participating in such a professional community are critical to the CoP's success and sustainability.

Silva's study (2000), while not specifically focusing on development of CoPs in science, provides a deeper understanding of the dynamics of team planning with elementary teachers. Her study looked at three teams of elementary teachers with very different demographics and experiences with designing an integrated language arts and social studies curriculum while under the leadership of a curriculum specialist. The purpose of Silva's study was to share the experiences these teachers encountered and describe how

each team made sense of the new integrated curriculum. Evidence from Silva's (2000) study suggests that "teams do not enact curriculum…Instead, teams become vehicles for curriculum decision making" (p. 292). Therefore, to develop a better understanding of team teaching at the elementary level, Silva suggested the need for gaining a deeper appreciation of the essence of teachers' experiences as part of a team, their beliefs, and their actions; in other words, their community of practice.

From this review of the literature one could conclude that when teachers are afforded the opportunity to work with colleagues, the quality of their teaching improves (Lumpe, 2007). Through the use of a CoP, teachers reflect with one another and are more willing to take risks in their teaching (Foulger, 2005). However, it is clear that further exploration is needed into the design and implementation of elementary CoPs at the classroom level. Therefore, studying the design and use of CoPs at the elementary level where science plays a critical role in the overall curriculum design would not only contribute to a scant literature base but may also help to address Roden's (2000) claim that change must occur at the elementary level to make science a first-class subject.

My study approaches this issue from much the same perspective as Silva's (2000) study – to gain the essence of this team's CoP experience through observing their interactions, and eliciting their own thoughts about their collaborative process. Therefore, the objective of this study was to record, interpret and share the experiences of four second grade teachers CoP; and in particular, the role of their CoP in helping them to achieve curricular coherency that is rooted in their knowledge and beliefs about teaching science as inquiry.

Research Design

This study employs both a case study approach and method of analyze. According to Creswell (1998), "some case studies generate theory, some are simply descriptions of cases, and other are more analytical in nature and display cross-case or inter-site comparisons" (p. 186). For the purpose of this study, a descriptive case study was adopted as the goal was to discuss the four participants as a collective whole in order to understand the dynamics of the team's community of practice with regards to supporting their use of science for designing curriculum coherency.

Context of Study

This study took place at an Elementary situated in a growing Midwest community. At the time of data collection, the total school population for this school was 465 with 86 students split among the four 2nd grade classrooms involved in this study. The total minority population was 24.5%.

In grades K-3 at this school the classroom teacher was responsible for teaching the core content areas of communication arts (literacy),

mathematics, science, and social studies. Students went to teacher specialists for art, music, and physical education and it was during this specialist time period that the teachers scheduled their bi-weekly team meetings.

Teacher Participants' Background

The four second grade teachers participating in this study were given the pseudonyms of Tracy, Brenda, Heather, and Nancy. I purposively selected these four teachers because of my various past professional experiences with three of them. Although I had not had any prior interactions with Nancy, she agreed to participate because of the focus on the team approach to interdisciplinary design. In addition to the four participating teachers, the school principal also contributed to the study by providing information on the dynamics of this teaching team in comparison to other teachers in the school, and the school's overall educational objectives.

At the time of this study, Tracy was in her 16th year of teaching. Over those 16 years she taught grades K-4, with the majority of her teaching time (11 years) at the second grade level. She explained that using an integrated approach to teaching had always played a significant role in her teaching practice, especially with her curricular design experiences during Drake's early years of following the *Basic School* (Boyer, 1995) model.

During the data collection period for this study, Brenda was in her 13th year of teaching. Similar to Tracy, Brenda had experience teaching several of the primary grade levels, although the majority of her teaching was split between two different schools teaching second or third grade. Brenda explained that the key to her teaching was to use an inquiry approach across all disciplines. Although she felt science and math lent themselves most easily to this approach, she also stated that the more comfortable she became with inquiry, she also found ways to apply inquiry-based practice to her teaching of reading and writing.

Heather had 14 years of teaching experience, all of which were in the second grade at Drake Elementary. She admitted that at the beginning of her teaching career that she preferred to teach mathematics, but over the years she grew to love and appreciate teaching science.

The fourth teacher of the team, Nancy had nine years of teaching experience at the time of this study with seven years at the second grade level at a school other than Drake, and two years as a Title 1 Reading teacher at Drake. Due to a cut in funding, the Title 1 position at Drake was removed, but the principal offered her a regular classroom position on the second grade team instead. Nancy believed that her main contribution to the team was her strengths in reading and writing, which was why she was selected to run the pullout reading program for the second grade students needing additional literacy support. This meant that she did not teach any of the science, but she still contributed to the team planning sessions and

taught other disciplines that were observed (reading, writing, and mathematics).

Data Collection

I observed and collected field notes in two different settings: 1) during team planning sessions, and 2) in individual teachers' classrooms. The team meetings were observed for 1½ hours each week for 10 weeks. They took place on Tuesday and Thursday afternoons and served two purposes. The Tuesday meeting afforded the teaching team the opportunity to reflect on what they had taught at the end of the previous week, how they had carried the learning forward during the current week, and what considerations they needed to make in adapting their teaching for the remainder of the week. The Thursday meeting acted as a checkpoint for the teachers; they often shared anecdotes about things their students said or did that may have shifted their thinking about their lessons for that week. Copies of handouts and schedules were collected at these meetings to support my analysis of these field notes.

The second setting for observation data was the teachers' individual classrooms. The purpose of these observation periods was to gather data on how the teachers connected the ideas discussed in their team meetings and implemented them into their individual teaching practice. I observed the teachers' classrooms during the same length of time as the team meetings (10 weeks). Overall, I gathered observational data on two and a half science units, but focused the majority of her data gathering on the first 6 weeks with the *Changes* unit, which examined changes in properties of matter and changes of state. During the final three weeks I spent the majority of my time observing the teachers' classrooms during reading, writing, and mathematics lessons. It was during these last few weeks that I had the opportunity to observe Nancy teach.

Finally, I used a standardized open-ended interview protocol (Patton, 2002) as a second source of data. I conducted a single open-ended interview protocol with the principal before beginning the 10 weeks of observation for the purpose of gathering background information and to establish the context for the study. I also conducted two interviews with the teachers, one at the beginning and one at the end of the 10-week observation period. The questions in the first interview asked the teachers to describe past teaching experiences, their goals and methods for designing their curriculum, and the role of science in this design. The second interview protocol focused on how their approach to teaching science influenced their teaching of other subjects, and the role that their team teaching approach had on enacting their interdisciplinary design.

Data Analysis

As a result of having employed case study method for data analysis, various themes emerged in response to the response to the four research questions. An integrated mode of examining these themes across participants' stories resulted in developing a rich description of their shared experience (Patton, 2002). Using a single case study approach for data analyze afforded me the opportunity to examine and report on these teachers experiences as a unit rather than individually. The unit of analysis for this particular study was the team, with each member of the team contributing to my understanding of their community of practice. This method of data analysis assisted us in staying focused on the purpose of the study, which was to examine the role of team planning in developing the team's shared understanding (Supovitz, 2002) of what it means to teach inquiry-based science and use this understanding to design a coherent curriculum.

Following the observations of the team meetings and the *Changes* unit, I wrote preliminary thoughts about the emerging themes observed in Tracy's, Brenda's, and Heather's instruction. This act of reflection (Wolcott, 1995) allowed me to begin bracketing my personal views about developing a community of practice and made me aware of the team's unique dynamics and the specific roles each member contribute to their community of practice.

I employed a content analysis process on both the field notes and the interviews, a technique often associated with case studies. The content analysis process was inductive in nature and involved two phases: 1) aligning the teachers' responses from what I observed and what the teachers stated in both sets of interview questions to the four research questions and 2) reviewing the teachers' responses for patterns that we could then develop into assertions to answer the research questions. Because this paper is part of a larger study, I focused my coding of interview data to comments that focused only on the role of team planning and I focused my analysis of the field notes to the team meetings mainly, using the observations of individual classroom teaching as a confirmation (through implementation) for what was discussed in the meetings. From my content analysis of the field notes and the interview data, three themes emerged: benefits, contributions, and commitment to professional development.

The vignettes described in the next section address research question one mainly, as they depict two sample team meetings illustrating the team's planning strategies and interactions with one another. Following the vignette section, in the findings and interpretations, I discuss how the theme of benefits addresses research question two and three and the theme of contributions refer to research question number four. The final theme, commitment to professional development is also discussed with respect to

how the teachers' view the role of professional development in developing their community of practice, but is not related to one specific research question.

Setting the Stage: A Window into Team Meetings

Brenda, Tracy, Heather and Nancy met regularly twice a week for an hour during their shared planning time on Tuesday and Thursday afternoons. The following two vignettes are representative of a typical Tuesday and Thursday meeting. They illustrate the role of each member and the kinds of conversations one could expect to hear during these meetings.

A Tuesday Afternoon

It is 2:30 and the second grade teachers are gathered in Nancy's classroom at her small group meeting table. They have their planning binders laid out in front of them and they are looking over what they have scheduled for the week.

Brenda initiates conversation with the question, "So tell me what you have been doing with writing?" Nancy is the first to respond, saying that she used the read-aloud book they have been discussing in class to look at the detailed style of writing the author used.

The team had participated in a book study the previous year that looked at Lucy McCormick Calkins' and Abby Oxenhorn's (2003) book *Small Moments: Personal Narrative Writing*. Each teacher was using the strategies from this book with their students. For example, their students select something they do in their daily life and write about that event. The goal is to have the students to go from a broad discussion of the daily event to a narrowed and detailed description of a brief moment within the event.

Nancy directs the conversation to publishing. For this piece of writing she wants the students to focus most of their time on revision writing rather than rushing to illustrate. So she is considering having her students complete a page that is folded in thirds instead a full booklet. She believes this will make the students focus on writing concisely and will leave less blank room. Heather says that she likes that idea because she was also thinking of making the illustrations more of a side item in order to keep the students' focus on improving their writing. However, she was thinking of having her students publish their small moment into a small booklet instead. Brenda says she is still in the brainstorming phase of writing with her students and that they have not really caught on to the significance of the detailed writing that is needed to go from a broad concept to a small moment. She has not yet thought about how they are going to publish their writing but asked to see some examples from Heather's and Nancy's students when they are finished.

As everyone else talks and shares their ideas Tracy writes in her planning binder on this week's schedule. She takes advantage of a brief

pause in the conversation to say to her colleagues that she is having similar difficulties as Brenda and that she feels better knowing she is not alone. She too wants to place less emphasis on illustrations and have the students focus more on the publication of their writing. She asks Nancy and Heather if she can photocopy the booklet formats they are considering using with their students to help her think about what she might want her students to do.

They all take a moment to write some notes down on their weekly plans. During this time the conversation starts to go off topic from planning their writing lessons to stories about their students. But Brenda brings them back on task by asking Nancy, "So what are you going to do again in writing tomorrow?" Brenda asks Heather the same question and Heather looks back and forth between Tracy and Brenda as she explains how she is helping her students to move their small moment revisions forward.

Nancy interjects with a question about the writing prompt assessment that they need to give their students next week. Tracy suggests doing it on Monday so they can get it over with at the beginning of the week and not have it interfere with the rest of their week. Brenda, Heather and Nancy all agree that this is a good idea. They block off the writing period for the assessment that day.

Tracy has to leave to pick her students up from the counselor. Nancy, Brenda and Heather stay for another 20 minutes to talk about some other lessons they have used since last Thursday and how they plan on building from those lessons for the remainder of this week.

Next the teachers start talking about the strategies they are working on with their students during Making Words. This is equivalent to spelling time in traditional classrooms. These teachers pull words from the content areas that follow similar spelling patterns and that students frequently encounter in their reading, writing, and speech. Heather shares a lesson where she used the story *Bubbles Popping* as a word study about combinations of long ā sounds. She says that she selected this book because it discussed a lot of the same ideas that the students were experiencing in their science unit. In particular she described an activity with an Alka-Seltzer tablet where the students observed different ways to dissolve the tablet at different rates. She explains that the book reinforced some ideas about dissolving while also introducing students to a more extensive vocabulary they can use when recording evidence in their science journals.

This connection between science and reading leads the teachers into a conversation about predictions. They share with each other different strategies that they are using in science to help the students develop predictions. They want to extend this beyond science and find ways to help their students become more comfortable with taking risks in making predictions in other content areas as well (e.g., reading response journals

and math discussions). After a few minutes of sharing different techniques that each of them use, they pause to write some ideas down in their planning binders.

Heather asks Brenda how her science class went that morning because she remembered from their last meeting that she was having some difficulties getting her students to develop questions. Heather asks, "Did they ask any questions? I am thinking I want to do the guided inquiry on Thursday prior to the ice experiment because my kids have started asking some interesting questions and I think they ready to begin a more open inquiry approach." Brenda explains that her students' questions are starting to get better, but that she ran out of time to ask them about their questions so they will not be ready for a more student-directed inquiry on Thursday. Heather says she might go ahead and start a more open approach to inquiry with them on Thursday anyway, rather than doing the next lesson in their *Changes* science unit.

At 3:20pm they start to wrap things up because Brenda, Nancy and Heather have to go pick up their students from the specialists and get them ready to for dismissal at 3:45pm. They each make some last minute notes in their planning binders. On their way out of the room, they discuss different materials that they would like to borrow from each other for the remainder of this week.

A Thursday Afternoon

It is 2:40pm and once again the four second grade teachers are gathered in Nancy's classroom around a small group discussion table. The conversation begins with Brenda saying that she is planning on doing her writing prompt preparation with her students tomorrow for their assessment on Monday. Nancy chimes in, saying that they started some of this preparation today. She describes the team the mini-lesson that she did with their students. Brenda then asks Heather what she did in writing today, Heather explains that she started some prompt writing today, but she is going to focus more on it tomorrow.

Tracy directs the conversation back to the small moment writing that they were doing at the beginning of the week. She explains that she has not had a chance to start this writing with her students. She is having difficulties getting her students to think from the broad concept to the more narrowed topic of a small moment. She has been thinking about how the others are approaching this writing style and that she is going to take a slightly different approach next week. For example, Nancy had her students focus on the sequence of writing what occurs in a small moment, but Tracy does not want to separate the show and tell part of the writing from the sequencing because this may be where some of the problems are coming from. She wants to try incorporating both sequencing and show and tell writing together.

After a brief pause, Tracy changes the topic from writing to math. She explains to the others that she wants to start working with some of the ideas from Chris Confer's (1994) book *Math by All Means: Geometry, Grades 1-2* to supplement the district's text. Tracy says she really likes the hold and fold activity that Confer suggests because it helps to develop students' math vocabulary. Brenda says that one of her favorite activities is *Rocket Discovery* because it deals with shapes within a shape. Tracy concurs. Heather and Nancy like the idea of using this book. They suggest some other books that they could connect the literacy and math pieces. One of them raises the idea of using the book *Cloak for the Dreamer* (Friedman, 1995) because of the discussion about shapes in the cloak design. The math planning conversation ends with talk about using ideas from Confer's book to decorate their classroom bulletin boards with a geometry theme.

While everyone takes a moment to write in their planners, Tracy changes the topic to science. She initiates this discussion with an explanation that the *Changes* unit they have been studying in science is meshing well with their reading she is having her students look for changes in story lines.

Brenda reminds Tracy to save the water from the ice melting activity from the *Changes* unit to use for the evaporation activity next week. Tracy responds, "O.K. Are you planning on moving forward with some discussion on the water cycle for a couple of days next week?" Brenda replies that she thinks they will take all of next week to cover the water cycle.

Brenda, Tracy and Heather discuss different books they can use to connect to the water cycle ideas they are going to be studying in science. Tracy says that she wants to begin her reading with fictional books that have elements of the water cycle in them. As they progress with their study of the water cycle in science, she will draw connections between the stories and the science concepts.

At this point all four teachers examine their reading books and begin to brainstorm how they can connect the books with the remainder of the *Changes* unit. They find a couple of books that focus on character change. They talk for a few moments about how the idea of character change could be incorporated into reading and the small moments writing. This conversation carries on for about 10 minutes, until one of them realizes it is 3:30pm. They quickly pack up and go their separate ways to pick up their students to get ready for school dismissal at 3:45pm.

Findings and Interpretations

According to these teachers, regular team planning sessions were a necessary part of their teaching practice. Based on our analysis of the data, we assert the following three claims as critical pieces to this team's vision and development of their community of practice. First, the teachers believed the benefits of team planning outweighed the time spent; second, they

valued the unique skills each member contributed to the group and as a result felt their teaching was stronger as a collective unit rather than individually; and third, each of them was committed to the idea that teachers need to be continually involved in professional development. For this team of teachers the bi-weekly team meetings were one way of ensuring they met this need for continuous professional growth. These three assertions are elaborated on below with embedded data provided to support each claim.

Benefits

For some teachers having only a couple of planning periods a week is not enough time to do all they have to do, so using the little planning time that they have to meet with other teachers may seem counterproductive. However, the members of this teaching team said just the opposite. For example, Tracy (Interview 1) explained that "without the team our approach to teaching would look very different, because I would be responsible for pulling everything together myself". Tracy seemed to suggest that the team approach actually saved her time and helped her to implement the inquiry-based curriculum she felt fit her teaching philosophy. The team meetings were not a burden on these teachers' time, but the most efficient way for them to gather new ideas and resources for their teaching.

Besides the time factor, these teachers described the support they give each other as another benefit of their twice weekly team planning sessions. They described the purpose of the planning sessions as a constant check-in for them to make sure that they were staying true to their curriculum, meeting their objectives, and addressing the needs of their students. According to Brenda, having the opportunity to meet regularly with her grade level colleagues ensured that she was reflective in her teaching practice.

> It is very beneficial whenever you can sit down together and brainstorm and figure out – O.K., this is working but this is not working out. Ask each other "Did this happen to you when you were doing this?" "Think about trying this whenever you are doing this lesson". Just having the time to talk things out is important. (Brenda, Interview 1)

In addition to encouraging reflection on their practice, the regular meeting times gave teachers the support they needed to take risks in their teaching and refine their ideas before putting them into practice. Heather commented on this when she said, "Having the team support allows you to try different things and take risks in our teaching. If you are alone you want to feel safe and secure, so instead of branching off with different ideas you may resort back to the manual more often". Brenda (Interview 1) noted, "Teachers get better at teaching when they work as a team. Learning goes up when you are asking questions, talking and problem-solving with others".

In summary, these teachers felt that their weekly Tuesday and Thursday meetings provided them with benefits that they could not get on their own. The meetings encouraged them to be reflective about their teaching practice, they provided an outlet to talk through problems and share strategies that worked, and increased their accessibility to resources (e.g., materials and teaching ideas). Overall, these teachers viewed their scheduled time together as a benefit rather than a detriment to their teaching practice.

Contributions

As the newest member of the team, Nancy described the collaborative atmosphere of the second grade teachers as a vital part of her success in returning to the classroom after several years as a reading specialist. Nancy acknowledged that, "Without this team I'd be struggling more and would feel isolated. I wouldn't be as reflective with my teaching nor would I be as willing to experiment with different teaching practices". She went on to say, "This team is rare. We are well matched with respect to skills, we value each other's strengths, and our personalities get along; we believe in each other professionally and personally" (Nancy, Interview 1).

I asked each teacher to describe her contribution to the team. In each case they identified a different attribute. However, each of them explained that the reason they valued their planning time together was not because of what they offered but because of what they gained. As Brenda (Interview 1) noted, "Just having the time to sit with three other experts that will help me plan things out is invaluable."

Because of the respect they showed for each others' expertise, I asked them to describe the contributions they felt each of their teammates offered. I learned that each person plays a specific role on the team. For example, Brenda's teammates described her as a manager, because she often initiated the discussion at the team meetings, kept the conversation on task, and was the first to provide suggestions when a teammate had an instructional question or problem. Tracy was identified as the person who made curricular connections across the content areas. Yet similar to Brenda, she often would initiate the team's conversation with curriculum questions. Serving a slightly different role, Heather was acknowledged as the organizer of the group, because she often took notes about their discussions and reminded them of special dates they needed to mark in their calendars (e.g., test dates and Grandparents Day). Under Heather's title as organizer, she was also a resource person for different lesson ideas, especially those that integrated the disciplines. Nancy's expertise was undoubtedly her experience as a Title 1 Reading Specialist. Therefore, Brenda, Tracy, and Heather all agreed that since science and mathematics were their strengths, Nancy's literacy background was a much-welcomed addition to the team.

Looking back at the two vignettes, one can see why these teachers identified each other with those particular characteristics. For example, in both vignettes Brenda initiated the conversation and managed the conversation to ensure that everyone had an opportunity to share what they were doing, ask questions, or simply comment on someone else's story. From time to time she also took responsibility for bringing the conversation back on task. For example, in the Tuesday Vignette, when the team started to go off task about planning their writing, Brenda redirected the conversation with a question to Nancy. Brenda asked, "So what are you going to do again in writing tomorrow?"

Tracy's role as curriculum connector was illustrated in the Thursday Vignette when she shared the connection between idea of changes they were studying in science and how she was having her students look for changes in storylines in reading. In this case, Tracy drew from two different experiences to share with her teammates how her students were grasping the concept of change because of the connections she made in both disciplines.

During the first vignette, Heather's role as team organizer focused more on her position as a resource provider. For example, Heather shared a lesson with her teammates in which she used the book *Bubbles Popping*. Throughout her description of this lesson, she explained how she used that book to connect to experiences the students had with the Alka-Seltzer activity in science, as well as how students used the vocabulary from that story in their science journals. A little later on in the Tuesday vignette, Heather's organization skills were revealed once again when she referred back to a previous meeting and asked Brenda if her students were starting to develop any of their own inquiry questions. This question served two purposes for Heather: 1) she wanted to check back in with Brenda to see how she was progressing with her students, and 2) Heather planned ahead for her own lessons and wondered about division of materials with Brenda's and Tracy's classes.

Not only did Nancy's teammates view her expertise in literacy as a valuable contribution to the team, but Nancy explained that it gave her a different perspective with which to consider how an inquiry-based approach to teaching meshed with disciplines other than science. She said,

> Because I am not a scientist when I think of inquiry I see it through the lens as a reader or a writer. I see the same [inquiry] skills used in science also used in literacy, but I look at it from a writer's perspective. So for example with poetry, what does inquiry look like in poetry? So bringing out a question for the [students] and then having them go investigate what things they are noticing as a writer. Then having them come back and collaborate and talk about it as a group, what things they are noticing and sharing these…So I guess my perspective is a little bit different from the others. (Nancy, Interview 2)

Because of this different perspective, most of Nancy's participation during the team meetings involved asking questions. Also, since she did not teach the science curriculum, she focused much of her discussion on reading, writing, and mathematics. She contributed to the geometry discussion in the Thursday Vignette when she and Heather suggested using the book *Cloak for a Dreamer* (Friedman , 1995) in reading at the same time they were doing the geometry unit in mathematics.

I observed these teachers portray consistent roles throughout the 10 weeks that I visited their team meetings. When they discussed classroom and curriculum issues, Brenda usually initiated the conversation, Tracy made curricular connections, Heather organized their plans for action with taking notes and distributing resources, and Nancy probed her teammates for their ideas and suggestions, as well as offered her assistance with literacy connections. Although their time together was informal and fun, it was also productive because each member came to the table prepared to ask questions and share ideas.

Commitment to Professional Development

This team's dedication to professional growth was something that was evident throughout each team meeting. There was several times throughout my 10 weeks at Drake Elementary that I heard these teachers refer to strategies they had read about in a professional book study or learned about in a workshop they had attended. For example, the team used writing strategies described in the Calkins and Oxenhorn book (2003) *Small Moments: Personal Narrative Writing* when they were planning for their next writing lesson. All four teachers were familiar with this book because they had studied it in their school's professional book club the previous year. The principal explained that participation in book clubs was voluntary, but often all four members of the second grade team took part. This reflects their orientation toward teaching as one of continuous learning.

For these teachers, professional development was an integral part of their teaching practice. According to both Tracy and Brenda, it was important for all teachers to think of their own learning as much as their students'. For example, Brenda (Interview 2) said,

> I think that it is really helpful [for teachers] if [they] are doing some kind of, not necessarily coursework, but something where [they] are reading, and have a group of people that [they] can talk with. For me it was coursework because that is what I love, but you know a book study or something like that [also works].

In these teachers' minds, the time they spent together was just another form of professional development. The twice weekly meetings gave them the opportunity to gather ideas and resources just as in any other professional development program outside of their school. Because of their like-minded

commitment to professional development, they viewed each other as professional resources for their teaching.

Discussion and Conclusions

For this team of teachers, team planning was not a requirement mandated from the outside; they deemed it necessary for successful implementation of their inquiry-based approach to a connected and coherent curriculum. They viewed second grade at Drake Elementary School not as four separate classrooms, but as a single unit which they facilitated as a teaching team. Their team approach served an important role in their instructional approach and offered several benefits to their teaching practice. Their community was defined by their individual contributions to the team's collaborative practice, which Manouchehri (2001) also noted in her study is a critical component to any CoP's success and sustainability. The third finding from this study, each member's commitment to professional development, provided some explanation as to how the team's understanding of inquiry-based science developed and was mutually agreed upon by each member of the community as the foundation for designing a coherent curriculum.

The conceptual framework informing this study was Wenger's (1998) notion of communities of practice (CoP). Wenger's description of a CoP was comprised of four components: community, meaning, practice, and identity. For the purpose of this study we do not discuss all these aspects of CoP. Instead we have chosen to elaborate two of these components – the teaching team's *practice* and how they generate *meaning* within their community. These two components were most clearly illustrated through the findings of this case study.

First, we focus on Wenger's description of practice in a CoP. Wenger stated that as "we interact with each other and with the world and we tune our relations with each other and with the world accordingly. In other words, we learn" (p. 45). Wenger explained that a CoP cannot withstand time if it is solely developed because a job requires it. Brenda, Tracy, Heather, and Nancy came together to learn from one another, and therefore formed their own CoP. For them teaching was not only a way to earn a living, but a passion. It was this team's sense of passion for teaching that constituted their community of practice.

The teachers' concept of practice was an experience that included both explicit and tacit meaning. Their views of *how* to design inquiry-based lessons was something they explicitly discussed at their twice weekly meetings, but their shared view of *what* constitutes inquiry-based instruction was implied within their community of practice.

Wenger (1998) stated, "Practice is about meaning as an experience of everyday life" (p. 52). To elaborate on this statement he argued that 1) meaning is located in a process called the *negotiation of meaning*, and 2) this

negotiation involves the interaction of two processes called *participation* and *reification*, which form a duality fundamental to the nature of practice. The teachers in this study were engaged in the process of negotiating meaning each time they met, whether it was during their scheduled team meetings or impromptu conversations over lunch. Any given school day, these teachers were faced with various questions or problems requiring a negotiation of meaning based on both the explicit and tacit understandings of their CoP.

Wenger's second argument about participation and reification looked at the process of how a CoP negotiates meaning. He described participation as sharing an experience with others in an activity or enterprise; therefore suggesting participation requires "both action and connection" (p. 55). Reification is a process that Wenger claimed is central to every CoP. He defined reifying as taking something (e.g., an experience) that is abstract and making it into something (e.g., a meaning) that is concrete. Using a wide range of reification processes (e.g., making, designing, representing, describing, perceiving, and interpreting) "human experience and practice are congealed into fixed forms and given the status of object" (p. 59). Wenger described the participation and reification as a duality rather than opposites.

With respect to this study, the teachers' participation and processes of reification played an integral part in the negotiation of meaning for their CoP. For example, based on their participation (action and connection with one another) and reification of such abstract concepts as inquiry and curricular connections, they developed a set of practices unique to their community.

Regarding Silva's (2000) findings on team teaching, the duality between participation and reification in the negotiation of meaning for a CoP plays an important role in how a curriculum is implemented. With regards to the team in this study, the characteristics of their CoP (e.g., commitment to professional development and individual expertise) guided their processes of participation and reification. In turn this led to both explicit and tacit negotiation of meaning about designing and implementing an inquiry-based coherent curriculum.

Implications

The findings from this study have implications for educators working with both preservice and inservice elementary teachers. From this study we have learned that regardless of the number of years of teaching experience, all teachers need to seek ways to develop professional collaborative relationships as they can play a critical role in their own reflective practice. This can be especially important for elementary preservice teachers just learning to teach science as they often do not feel confident teaching science. Requiring them to establish these kinds of relationships as students in their science methods classes may encourage them to look for similar

relationships with colleagues during their induction years and onwards. The development of a CoP that includes both new and experienced teachers may help to foster a more consistent inquiry-based science program throughout an elementary school. With regards to inservice teachers, many of the benefits discussed by the teachers in this study may benefit any experienced teacher. It is always important for teachers to challenge their own learning, and this is especially true for teaching science. The National Science Education Standards (National Research Council, 2000) refers to quality science teaching as being inquiry-based. This kind of curriculum requires teachers to think beyond the cookbook steps of a textbook and engaging in questioning and exploration with their students. As the teachers in this study explained, a CoP offers a safety net for teachers to question, debrief, and reflect with colleagues so they will be more willing to take the risks that an inquiry-based approach to teaching science sometimes requires. Finally, there are also implications from this study for school administrators. For science to be valued in elementary classrooms, administrators need to learn first-hand the instructional strategies teachers are learning in professional development so they will give them the support (e.g., time to meet collaboratively) that they need to design and implement quality curricula that includes science.

This case study contributes to the current body of literature on improving the quality of elementary science instruction. According to Roden's (2000) statement that science is viewed as a second-class core subject in elementary classrooms, it is clear that there is a need for providing classroom teachers with practical solutions for incorporating more science into their curriculum by drawing from the resources around them. The CoP these four teachers had developed demonstrates the possibility for quality science in elementary classrooms when planning and implementing instruction for all subject areas that mirrors inquiry-based science teaching.

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Biographical Statement

Meredith Park Rogers received her Ph.D. in Curriculum and Instruction, with an emphasis in Elementary Science Education, from the University of Missouri in 2006. She is currently an assistant professor of science education at Indiana University and oversees the elementary science education program. Her research interests include teacher knowledge, pedagogical content knowledge specific for teaching elementary science, and approaches to improving teacher professional development.

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The concurrent development of spelling skills in two languages

Rhonda JOY*
Memorial University of Newfoundland and Labrador, Newfoundland, Canada

Abstract

The study reported on in this paper investigated the concurrent development of spelling in children learning two languages. The study compared over time and between languages the types of spelling errors made in English as a first language and French as a second. Forty-seven grade one English-speaking children completed an English and French spelling task in October and May of the school year. The study relied on a repeated measures design using 2-tailed paired sample *t*-tests at the beginning and end of the school year. Results revealed students made more basic spelling errors at the beginning of the year and more complex spelling errors at the end of the year in both French and English. Despite the lack of direct instruction in English, students' English spelling skills developed over the course of the year suggesting that transfer of skills was occurring between languages.

Keywords: spelling development, elementary education, bilingual teaching, language teaching, second-language learning.

Introduction

Learning to spell is important as it is intricately connected with learning to read (Ehri, 2000). However, it is a complex developmental task because it requires children to learn the sound-symbol connection as well as more than 2000 rules of the language (Venezky, 1970). It can be a difficult task in the English language which is made up of about 40 units of sound with only 26 letters used to represent them (Treiman, 1993). When children are learning to spell in a second language in addition to their first, spelling can become even more complex. A number of studies have reported the impact of both negative and positive language transfer in children learning two languages (see Fashola, Drum, Mayer & Kang, 1996; San Francisco, Mo & Carlo, 2006; Wang and Geva, 2003). Language transfer refers to the impact of one's knowledge in one language on learning or performing in another language (Figueredo, 2006).

* Correspondence: Dr. Rhonda Joy, Faculty of Education, Memorial University of Newfoundland, Prince Philip Drive, St. John's, NL, CA, A1B 3X8. Phone: 709-737-6922. Fax: 709-737-2345. E-Mail: rjoy@mun.ca

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The concurrent development of spelling skills in two languages has not been studied extensively. Studies that have been conducted suggest that orthographic depth and the similarities of the languages involved affect how easily and whether or not information is transferred from one language to another (see Arab-Moghaddam & Senechal, 2001; Davis, Carlisle & Beeman, 1999; Liow & Lau, 2006). Orthographic depth is determined by the degree of correspondence between sounds and the letters that represent them. Deep orthographies such as English or French, in which sound-symbol correspondence is inconsistent, would be harder to learn than more shallow orthographies, such as Spanish or German in which the correspondence is more consistent. As an example, Sun-Alperin and Wang (2008) observed that young native Spanish students' English spelling errors were influenced by their Spanish orthography.

Error analysis of spelling in languages with different orthographic depths has been the subject of a small number of studies (see San Francisco et al., 2006; Sun-Alperin & Wang, 2008; Wang & Geva, 2003). This type of analysis can help identify areas needing remediation in instruction. It can signal individual disabilities that could negatively affect a child's ability to read. Error analysis of spelling in languages with different orthographic depths in contexts where children are learning two languages can also provide insight into transfer and into how orthographic knowledge or knowledge about spelling in one language might be used in another language. This type of analysis can be used in a context of studying the concurrent development of spelling skills in two languages.

The purpose of the study reported on in this paper was to analyze the errors made in spelling in the context of the concurrent development of spelling skills in a context of second-language learning. The context for the inquiry was grade 1 French Immersion with children whose first language was English. French Immersion (FI) is a second language program in which French is the "language of instruction for teaching of other subjects as well as French Language Arts during the entire… or significant portion" of the day (MacFarlane, 2005, p.3). The study compared errors between languages and over time. The study's research questions were as follows:

1. What types of spelling errors do students make in French and English?
2. How do the English spelling errors change from the beginning to the end of grade 1?
3. How do the French spelling errors change from the beginning to the end of grade 1?
4. How do the French and English spelling errors compare at the beginning of grade 1?
5. How do the French and English spelling errors compare at the end of grade 1?

A review of the literature on spelling development

First language spelling development

Various researchers have used stage theory to investigate first-language spelling development in children (e.g., Ehri, 1986; Frith, 1985; Templeton & Bear, 1992). According to stage theory, children begin spelling with minimal knowledge of the alphabet. The mastery of the letters of the alphabet provides a strong foundation for learning to read and spell (Adams, 1990). As children learn the alphabet, they learn how to represent some sounds of words with letters but not all of them.

Some authors argue that spelling development is more complex than stage theory suggests and that children, from the beginning of their contact with print, rely on multiple strategies and many types of knowledge when they spell (Kemp, 2006; Senechal, 2000; Senechal, Basque & Leclaire, 2006; Treiman, 1993; Treiman & Bourassa, 2000; Treiman & Cassar, 1997). As their spelling skills progress, children learn about patterns of letters in words or orthographic knowledge. They begin to use morphological knowledge or knowledge about the structure of words (e.g., dirt/dirty; farm/farmer are related) and strategies such as visual checking (Ehri, 2000). However, Treiman (1993) found that grade one children were not yet aware of morphology and consistently misspelled inflected words such as "helped" as "helpt". Sprenger-Charolles and Casalis (1995) also noted that the development of correct spelling for one word may occur at a different rate than the correct spelling of another word. They found that this development depended on factors such as environmental exposure and the difficulty of the type or sequence of letters used in a word.

Phonological awareness also plays an important role in spelling development (Bruck & Treiman, 1990; Treiman, 1993; Vellutino, Fletcher, Snowling & Scanlon, 2004). Despite the irregularities of the pronunciation of some phonemes (units of sound), children appear to quickly learn and use their phonological knowledge to assist in their spelling of words (Varnhagen, 1995). Many beginning spellers use a letter-name strategy ("b" for "bee") to spell a word (Read, 1971; Treiman & Bourassa, 2000). By grade one, most students can break a word into its onset and rime or syllables but may experience some problems breaking words into their individual phonemes (Treiman, 1993).

Other researchers have observed that students encounter most difficulty with vowels and separating consonants blends into their constituents (see Read, 1971; Treiman, 1985; Varnhagen, Boechler, & Steffler, 1999). Treiman (1993) found a number of other common errors among beginning spellers. These include omission of a letter, addition of a letter, reversals of the letter order of a word (e.g., her= hre) and the substitution of correct letters in a word for incorrect letters (e.g., cat=cit). Another common error is the incorrect use of the final "e" and other final letters (e.g., cat=cate). Treiman suggested

that this latter type of error was due to exposure to these types of patterns in printed words or an exaggerated sounding-out process.

Second language spelling development

Some research indicates that phonological knowledge plays an important role in learning how to spell in a second language (e.g., Fashola et al., 1996; Geva, Yaghoub-Zadeh & Schuster, 2000). However, the orthographic depth and the similarity of the languages being studied greatly impacts how easily (and whether or not) information is transferred from one language to the other (Arab-Moghaddam & Senechal, 2001; Davis, Carlisle & Beeman, 1999; Liow & Poon, 1998; Verhoeven, 1990). For example, German children encounter less difficulty in learning to spell vowels than do English children, due to the shallow orthography of their language (Wimmer & Landerl, 1997).

St. Pierre, Laing and Morton (1995) and others (Fashola et al., 1996; Sun-Alperin and Wang, 2008; Wang and Geva, 2003) have observed negative transfer in spelling. St. Pierre et al. studied a group of grade three FI students and found their use of knowledge of the French orthography negatively impacted their spelling of English words. Geva, Wade-Woolley and Shany (1993) and Wade-Woolley and Siegel (1997) found that whether English speaking children were learning Hebrew as a second language or whether it was English as an second language or native speakers of English, similar spelling development patterns were demonstrated in their respective first and second languages.

Geva et al. (1993) also found that students did not develop accurate spelling of all Hebrew words at the same rate. Development of the correct spelling of a word was dependent on the complexity of the spelling pattern to be learned. Cormier and Kelson (2000) demonstrated that the spelling of plurals in French than in English. Cormier, Landry, Jalbert, Caron and Hache (1999) also observed the importance of morpho-syntactic awareness for young FI children and native French children when attempting to spell words with unarticulated (silent) morphemes (e.g., chiens).

Although first and second language spelling may develop in a similar pattern, it appears that certain error types may be due to differences in the nature of the orthography. Previous studies have focused on specific types of spelling errors such as vowels or voicedness (e.g., “s” in pleasure) (Ferroli & Shanahan, 1993; Sun-Alperin & Wang, 2008) and on languages other than French or English as the first language (e.g., Fashola et al., 1996; James & Klein, 1994; Wang & Geva, 2003; Zutell & Allen, 1988), the study reported on in this paper analyzed the types of first and second language spelling errors at the beginning and end of the grade 1 school year in order to investigate how the spelling of words develops in a context of the concurrent development of spelling skills in two languages with deep orthographies.

Method

Participants

The study's participants were 47 six and seven year old students who were drawn from three classes of grade one FI students an urban and suburban school in the Canadian province of Newfoundland and Labrador. Only children whose parents consented to their participation, whose first language was English and who had no formal instruction in the first or second language prior to kindergarten were included. The participating students were not instructed directly in French or English at home. They were read to in French or English on a regular basis. As well, some children were exposed to French through a sibling in FI, a relative with some French background or French television.

In this province, English Language Arts is not formally introduced to FI students until grade three. The only subjects taught in English in kindergarten and grade one are Physical Education and Music. In grade three, one hour of formal English instruction per day is introduced with the hours of instruction increasing every year thereafter. The majority of children who enter grade one FI cannot speak in French. Once letters and sounds are reviewed, emphasis is placed on building children's oral language skills through song, games and poetry. Oral language skill building is linked with writing such that the vocabulary children learn is being used in their writing.

Instruments

Spelling task. The students' first and second language spelling skills were tested in October (T1) and May (T2) using the spelling subtest of the Wide Range Achievement Test-Revised (WRAT-R) (Jastak & Jastak, 1984) and the Canadian French Individual Achievement Test (FIAT) (Wormeli & Ardanaz, 1987). Students were read a word. A sentence was read with the word in it, the word was repeated again and then students were asked to print the word. The testing followed the same format as the FIAT spelling subtest.

Procedures

The study relied on a repeated measures design using 2-tailed paired sample *t*-tests at the beginning and end of the school year (Gravetter & Wallnau, 2004). This design allowed for the examination of the same group of students at two different times. The spelling tasks were administered by the classroom teacher and/or two graduate students in a group setting. To ensure comprehension of the task, directions were read to students in English with one or two examples of each task reviewed with the group before testing.

English spelling task. Students were asked to spell a number of words. Spelling continued until all students had reached a ceiling of at least 10 consecutive errors on the spelling words. Some students reached a ceiling earlier than others but testing continued until it was clear that the ceiling had been reached by all students. Spelling scores were totaled and then converted into a percentage score out of 40.

French spelling task. French testing followed the same format as English testing. Students' spelling scores were totaled separately and then converted into percentage scores out of 55 items.

Analyses

Spelling errors made during the English and French spelling tasks were categorized based on the types of errors made. These error types were then organized into error categories commonly found in the literature (e.g., vowels, see Treiman, 1985, 1993). Errors could be scored in more than one category in this system. Reliability of this scoring system was checked by using two independent scorers. Descriptive statistics (mean, standard deviation) as well as 2-tailed paired sample *t*-tests were used to compare student errors. Due to the large number of paired sample *t*-tests that were required, a *p*-value of .001 was used.

Results

What types of spelling errors do students make when spelling in French and English?

Table 1 presents the types of errors in spelling. Analysis revealed five main types of errors: primitive, consonant, vowel, transfer and other.

Table 1. *Types of spelling errors (examples are in parentheses)*

Primitive errors	-visual letter confusion (b/d, q/p) -random letters (make=l) -multiple representation of the first phoneme or letter of a word (ll,kk)
Consonant errors	-phonetic letter confusion (f/v, d/t) -silent consonant attempted (bas=bac) -silent consonant omitted (bas=ba) -consonant omission (make=ma) -related consonant substitution (reash=reach) -homophone letter confusion (sa=ca)
Vowel errors	-silent vowel attempted (maik=make) -silent part of vowel omitted (mak=make) -vowel omission (mk=make) -related vowel substitution (mok=make)
Transfer	-homophone transfer (jupe=gupe, lui=lwe)
Other	-over-pronunciation (ine=in, hime=him) -intrusions (make=manke) -reversal of phonemes in words (bannae=banana, ni= in) -incomplete orthographic representation (blanche=blance) -spelling by analogy (chatleur=chaleur) -same language homophone (dans=dent)

How do the English spelling errors change from the beginning to the end of grade 1?

Table 2 presents a comparison of types of errors made in English spelling from the beginning (T1) to the end (T2) of grade 1. Mean, standard

deviation as well as 2-tailed paired sample *t*-tests were used to compare student errors. Vowel and consonant omissions and omission of the silent part of vowel spelling errors decreased. However, attempts at silent vowels, vowel substitution, over-pronunciation errors increased. Students' mean errors in each error category did not consistently decrease over time. In fact, students' errors in some categories increased significantly. However, silent vowel omissions consonant omissions, and vowel omissions decreased significantly in English from T1 to T2.

Table 2. Change in spelling errors made in English at T1 and T2.

Error Type	T1		T2		
	M	SD	*M*	SD	*t (46)*
Primitive					
Visual	.02	.15	.02	.15	.00
Multiple Rep.	.57	.83	.30	.75	2.46
Random	.00	.00	.00	.00	
Consonants					
Phonetic Confusion	.60	.85	.45	.58	1.27
Silent Attempted	.00	.00	.00	.00	
Silent Omitted	.00	.00	.00	.00	
Consonant Omitted	5.00	2.42	2.87	2.05	6.71***
Related Con Sub.	.02	.15	.04	.20	-.57
Homo Let. Confus	1.64	.87	1.55	.83	.50
Vowels					
Silent Attempted	.17	.48	.85	.83	-5.76***
Silent Part Omitted	2.85	1.20	1.94	1.11	4.22***
Vowel Omitted	5.23	1.91	2.72	1.85	7.54***
Related Vow. Sub	1.81	1.28	2.87	1.64	-3.53***
Transfer					
Homo Transfer	.02	.15	.00	.00	1.00
Other					
Over-Pronun.	.19	.45	.83	.79	-.34***
Intrusions	2.79	2.90	3.70	2.61	-2.14
Reversal of Phoneme	.04	.20	.00	.00	1.43
Incomplete Ortho.	.26	.57	.53	.80	-1.87
Spell by Analogy	.09	.28	.23	.43	-2.00
Same Lang. Homo	.00	.00	.02	.15	-1.00

Note 1. ***$p \leq .001$

Note 2. Visual= visual letter confusion; Multiple Rep= multiple representations of the first phoneme or letter of a word; Random= random letters; Related Con Sub= related consonant substitution; Homo Let Confus= homophone letter confusion; silent part omitted= silent part of vowel omitted; Related Vow Sub= related vowel substitution; Homo Transfer= homophone transfer from English to French; Over-Pronun= over-pronunciation; Incomplete Ortho= incomplete orthographic representation; Same Lang Homo= same language homophone.

How do the French spelling errors change from the beginning to the end of grade 1?

Table 3 presents a comparison of the types of errors made in French spelling from the beginning (T1) to the end (T2) of grade 1. Over time, some types of errors decreased while others increased. In particular, vowel omissions decreased. French over-pronunciation errors, attempts at silent

vowels, vowel substitution, intrusions and incomplete orthographic representation errors increased significantly.

Table 3. Change in spelling errors made in French at T1 and T2

Error Type	T1		T2		
	M	SD	*M*	SD	*t (46)*
Primitive					
Visual	.11	.38	.34	.67	-2.12
Multiple Rep.	.81	1.39	.38	1.05	2.09
Random	.00	.00	.00	.00	
Consonants					
Phonetic Confusion	.13	.34	.17	.56	-.42
Silent Attempted	.04	.20	.02	.15	.57
Silent Omitted	.43	.54	.38	.53	.42
Consonant Omitted	3.79	1.93	3.17	2.37	1.54
Related Con Sub.	.06	.25	.21	.59	-1.73
Homo Let. Confus	0.81	.68	1.57	.65	1.60
Vowels					
Silent Attempted	.00	.00	.55	.75	4.68***
Silent Part Omitted	4.77	1.95	4.51	2.01	.62
Vowel Omitted	4.57	2.39	3.04	2.66	3.30**
Related Vow. Sub	.79	1.18	2.74	1.42	7.30***
Transfer					
Homo Transfer	.57	.72	.66	.94	-.53
Other					
Over-Pronun.	.09	.28	.53	.62	4.47***
Intrusions	2.26	2.16	4.02	2.78	3.90***
Reversal of Phoneme	.19	1.17	.00	.00	1.12
Incomplete Ortho.	.02	.15	.66	.89	-4.76***
Spell by Analogy	.60	.74	.87	.99	-1.57
Same Lang. Homo	.13	.34	.23	.48	1.40

Note. ***$p \leq .001$, **$p \leq .01$

How do the English and French spelling errors compare at the beginning of grade 1?

Table 4 shows that some spelling errors were more common in one language than in the other at T1. At T1, omission of silent consonant, attempts at a silent part of a vowel, transfer, and spelling by analogy errors were significantly more common in French than English. Phonetic letter confusion, consonant omission, homophone letter confusion incomplete orthographic representation and vowel substitution errors proved to be significantly more common in English.

Table 4. Comparison of spelling errors between languages at T1.

Error Type	T1		T2		
	M	SD	*M*	SD	*t (46)*
Primitive					
Visual	.02	.15	.11	.38	1.43
Multiple Rep.	.57	.83	.81	1.39	1.13
Random	.00	.00	.00	.00	
Consonants					
Phonetic Confusion	.60	.85	.13	.34	3.29**
Silent Attempted	.00	.00	.04	.20	1.43
Silent Omitted	5.00	.00	.43	.54	5.39***
Consonant Omitted	5.00	2.42	3.79	1.93	3.28**
Related Con Sub.	.02	.15	.06	.25	-1.00
Homo Let. Confus	1.64	.87	.81	.68	5.22***
Vowels					
Silent Attempted	.17	.48	.00	.00	2.43
Silent Part Omitted	2.85	1.20	4.77	1.95	-6.88***
Vowel Omitted	5.23	1.91	4.57	2.39	1.99
Related Vow. Sub	1.81	1.28	.79	1.18	4.35***
Transfer					
Homo Transfer	.02	.15	.57	.72	-5.53***
Other					
Over-Pronun.	.19	.45	.09	.28	1.30
Intrusions	2.79	2.90	2.26	2.16	1.58
Reversal of Phoneme	.04	.20	.19	1.17	-.87
Incomplete Ortho.	.26	.57	.02	.15	2.69**
Spell by Analogy	.09	.28	.60	.74	4.51***
Same Lang. Homo	.00	.00	.13	.34	-2.60

Note. ***$p \leq .001$, **$p \leq .01$

How do the English and French spelling errors compare at the end of grade 1?

Table 5 shows that students' errors at T2 differed with some errors more evident in one language than in the other. At T2, homophone letter confusion errors occurred significantly more often in English. A number of errors occurred significantly more often in French than in English. Visual letter confusion, silent consonant omission, silent vowel omissions, transfer, same language homophone and spelling by analogy errors occurred significantly more often in French. While students made some similar errors in both languages at T1 and T2, there were differences in the type and frequency of errors made depending on the language and time-frame examined.

Table 5. Comparisons of spelling errors between languages at T2.

Error Type	T1		T2		
	M	SD	*M*	SD	*t (46)*
Primitive					
Visual	.02	.15	.34	.67	3.15**
Multiple Rep.	.30	.75	.38	1.05	-.63
Random	.00	.00	.00	.00	
Consonants					
Phonetic Confusion	.45	.58	.17	.56	2.55
Silent Attempted	.00	.00	.02	.15	-1.00
Silent Omitted	.00	.00	.38	.53	4.92***
Consonant Omitted	2.87	2.05	3.17	2.37	-.94
Related Con Sub.	.04	.20	.21	.59	-1.83
Homo Let. Confus	1.55	.83	1.57	.65	5.65***
Vowels					
Silent Attempted	.85	.83	.51	.75	2.69**
Silent Part Omitted	1.94	1.11	4.51	2.01	9.48***
Vowel Omitted	2.72	1.85	3.04	2.66	-.90
Related Vow. Sub	2.87	1.64	2.74	1.42	.51
Transfer					
Homo Transfer	.00	.00	.66	.94	-4.82***
Other					
Over-Pronun.	.83	.79	.53	.62	2.25
Intrusions	3.70	2.61	4.02	2.78	-1.12
Reversal of Phoneme	.00	.00	.00	.00	N/A
Incomplete Ortho.	.53	.80	.66	.89	-.97
Spell by Analogy	.23	.43	.87	.99	3.87***
Same Lang. Homo	.02	.15	.23	.48	3.15**

Note. ***$p \leq .001$, **$p \leq .01$

Discussion and conclusion

In general, the spelling error analysis results revealed that some errors decreased over time while others increased. These changes occurred in both French and English spelling even though children were not instructed in English. This result suggests that children may transfer what they learn about French orthography in the classroom to English spelling. However, this transfer takes time to master. At T2, as compared to T1, students engaged in more vowel substitutions, over-pronunciation errors, more intrusions and incomplete orthographic representations and finally, made more errors in their attempts at including the silent part of a vowel. By the end of the year, students' orthographic knowledge had increased and they were able to apply some of the rules they had learned. However, they were uncertain and inconsistent in the application of this knowledge. For example, while students' omissions of silent vowels decreased from T1 to T2, their silent vowel attempts increased from T1 to T2. They understood that a silent vowel

was needed in a spelling word but were uncertain about how to use this rule. The fact that English spelling skill errors are changing despite lack of instruction suggests that there may be some transfer of skills from French to English. The use of English spelling in the spelling of some French words also suggests there may be transfer from English to French. These results are similar to that of Wang and Geva (2003) and Geva et al. (1993).

Ehri's (1986) stages of spelling development may help explain some of the results of this study. Students made more basic errors such as consonant omissions at the beginning of the year. By the end of the year their approximations to the correct spelling had improved but errors were more complex. They engaged in more attempts at silent vowels and vowel substitutions as their approximations to the correct spelling improved. Treiman and Bourassa (2000) suggest that these stages do not fully capture spelling development. They argued that it is critical to consider the multiple spelling strategies children use. For these children, their strategy use became more complex as their orthographic knowledge increased. For example, children used a first language analogy to spell the second language word "lui" as "lwe". Goswami (1988) and Sprenger-Charolles and Casalis (1995) also found that children used more complex strategies such as analogies or familiar words to help spell unfamiliar words.

The increase in intrusion errors (e.g., bas=baas) in French may be due, not only to lack of exposure, but to students' lack of mastery of orthographic rules and sound-symbol correspondence rules. At this stage in their spelling development, students were being introduced to many new words and rules. As a result, they may not have been able to accurately or consistently apply the acquired knowledge. For example, "carte" was spelled as "cardte", which may indicate that students knew that a "d" or "t" sound or both was at the end of the word.

As was found in other studies (e.g., Ehri, 1986; Treiman, 1993; Varnhagen et al., 1999), vowels were more problematic for students than consonants. This increase in some vowel errors from T1 to T2 in both French and English may be attributed to students' lack of mastery and more awareness and confusion about possible ways to spell a vowel sound. Over-pronunciation (in= ine/ina; lave=lavea) errors also occurred more frequently in French and English at the end of the year. Treiman (1993) suggested this type of error was due to a lack of exposure to print or an exaggerated sounding-out process.

Incomplete orthographic representations (blanche=blance) errors increased in French. Students were not always aware of how to represent the consonant blend. Treiman (1985) and other researchers have noted that the separation of consonant blends into their constituents is difficult for young students.

While students displayed an increase in a number of errors in both French and English, there were more error types noted in French at the end

of the year. This increase in additional types of errors in French may be attributed to the types of words used in the spelling task or the fact that students are acquiring more knowledge in French, the language of instruction, and were trying to apply that knowledge. Vowel omission errors decreased by the end of the year in French and English. However, consonant omissions and omission of the silent part of the vowel errors were also significantly reduced in English. It is possible that students' knowledge of the rules of language was increasing and they were able to apply this knowledge to their spelling.

When comparing the types of errors made in French and English, a number of observations can be made. Regardless of the time of year, students made significantly more errors with silent vowels and silent consonants, transfer and spelling by analogy errors in French than in English. The higher incidence of silent phonological element errors in French than English may be attributed to the French orthography where many were unarticulated or silent vowels. These findings support Senechal's (1999) and Cormier et al.'s (1999) results which suggested that students have more difficulty with a word's unarticulated letters than with articulated letters.

The increased occurrence of homophone transfer from English to French (e.g., j=g; lui=lwe) and spelling by analogy (e.g., chaleur = chatleur) errors in French may be attributed to students' minimal spelling knowledge in French and their reliance on the English orthography when they are uncertain of a spelling. Students transfer or apply their knowledge of the English orthography to assist them in spelling French words. So, as these children progress through grade one, they are transferring knowledge from French to English and from English to French. While these grade one FI students tended to rely on English letters to represent French sounds, St. Pierre et al. (1995) found the opposite results in their study of grade three FI students. Further research is needed to better understand if this discrepancy might have been due to the age of the students and/or differences in methodology. Visual letter confusion (e.g.; b/d; p/q) and same language homophone (e.g.; dans=dent) errors also occurred more frequently at the end of the year in French. Visual letter confusion is normal for children in grade one and the homophone errors were likely due to the words used in the spelling task.

When comparing the error types that were more pronounced in English than French, a different pattern develops. In the beginning of the year, it is the more basic error types such as phonetic letter confusion (e.g., d/t), consonant omissions, together with errors such as homophone letter confusion (e.g., c=s, c=k), vowel substitution and incomplete orthographic representation errors which are more pronounced in English. The increased occurrence of these errors in English over French may be attributed to the particular words used in the spelling task and the differences between the two orthographies. It is also possible that the higher incidence of these basic errors may be due to a lack of direct instruction in English. By the end of the year, students' were making more homophone letter confusion (e.g., s=c, c=k)

errors in English than in French. This may be attributed to the particular words used in the spelling task.

In conclusion, the study reported on in this paper provided insight into the concurrent development of spelling skills in French and English which both have deep orthographies. Results revealed that the type of spelling errors varied depending on the time frame and language being examined. Students' spelling errors displayed variability with some types of errors increasing and others decreasing. In general, regardless of whether French or English spelling error types are considered, students' errors changed over time suggesting a progression of orthographic knowledge. Regardless of the time of year, students encountered more difficulty with silent vowels and consonants errors, transfer and spelling by analogy errors in French than in English. More basic errors such as consonant omission and phonetic letter confusion were more common in English than in French. By the end of the year, homophone letter confusion errors were the only errors occurring more often in English than in French. .

The time-frame and sample size used for this study place limitations on the findings. A number of testing issues also pose limitations. The FIAT, the only French achievement test available at the time of this study, was dated. Task equivalency between the French and English measures may also place limitations on the study as it is very difficult to ascertain assessment instruments that can be controlled on all dimensions (e.g., word length, syllable structure, etc) of equivalency. For example, the spelling of a word in one language may not mirror that of its translation in the other language (e.g., "red" vs "rouge". The categorization of spelling errors on the spelling task also posed some problems. When an error was made the examiner had to interpret what the student was attempting to do when the error was made. For example, when a student spelled "him" as "hime", the examiner needed to decide if this was an attempt at a long vowel, or if the students simply thought the word looked better with an "e" at the end.

In terms of implications, this study has provided insight into the specific errors that grade one French as a second language students make at the beginning and end of the year. This information can be used by teachers and educational psychologists to observe student progress and determine if students need closer monitoring or intervention. For example, if a student was still encountering difficulty with basic spelling errors such as vowel omissions at the end of the year, further investigation of that student's progress may be warranted. However, an increase in errors in vowel substitution or over-pronunciation, based on this study, would be expected. As well, knowing that students at this age experience difficulty with these specific areas allows teachers to focus on these error types in the classroom in an effort to provide support for this stage of spelling development. This study also highlighted the differences in the types of errors students make in English and French. Again, knowing what types of errors students make in each language will allow teachers to focus on these areas in their teaching.

Despite the lack of direct instruction in English, these students' English spelling skills were developing. The transfer of knowledge from French to English suggests that young students can learn a second language and transfer some of their skills to learning in their first language.

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Biographical statement
Dr. Rhonda Joy is Assistant Professor in the Faculty of Education at Memorial University of Newfoundland, Canada. She is engaged in research in the area of reading development among second language learners. She is a former guidance counselor and educational psychologist.

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Collaborative teaching of an integrated methods course

George ZHOU*

University of Windsor, Canada

Jinyoung KIM

The City University of New York, United States of America

Judit KEREKES

The City University of New York, United States of America

Abstract

With an increasing diversity in American schools, teachers need to be able to collaborate in teaching. University courses are widely considered as a stage to demonstrate or model the ways of collaboration. To respond to this call, three authors team taught an integrated methods course at an urban public university in the city of New York. Following a qualitative research design, this study explored both instructors' and pre-service teachers' experiences with this course. Study findings indicate that collaborative teaching of an integrated methods course is feasible and beneficial to both instructors and pre-service teachers. For instructors, this collaborative teaching was a reciprocal learning process where they were engaged in thinking about teaching in a broader and innovative way. For pre-service teachers, this collaborative course not only helped them understand how three different subjects could be related to each other, but also provided opportunities for them to actually see how collaboration could take place in teaching. Their understanding of collaborative teaching was enhanced after the course.

Keywords: Collaborative teaching; integration; methods course; elementary teacher education.

Introduction

Collaborative work is defined as two or more people working together. Effective collaboration is mandatory for success in the context of a workplace such as today's business environment (Beyerlein & Harris, 2003). In the area of education, scholars and practitioners have advocated the importance of collaboration as well for a while. As a result, collaboration between university

* Correspondence: Dr. George Zhou, Faculty of Education, University of Windsor, 401 Sunset Ave. Windsor ON Canada N9B 3P4. Telephone: (519)253 3000 ext 3813. E-mail: gzhou@uwindsor.ca

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and industry, college and community, and teacher education institutions and k-12 schools is no longer new to many people. However, collaborative teaching within k-12 schools appears to be an untapped area. The current categorical approach to teacher preparation and lack of attention to collaborative skills are the first barriers to effective collaboration in schools (Villa, Thousand, Nevin, & Malgeri, 1996). Friend (2000) reminds us that collaborative skills do not come naturally; they need to be honed and cultivated. Many scholars therefore suggest that university courses should be employed as the stage where pre-service teachers are exposed to various collaborative practices (Kluth & Straut, 2003; Quinlan, 1998).

To respond to this call for collaboration in teacher education courses, three authors collaboratively taught one multidisciplinary methods course (EDE 303) for three semesters at an urban public university in the city of New York. This course was designed for an elementary teacher education program. It covered three subjects: science, math, and music. The fundamental purpose of this course was to develop pre-service teachers' pedagogical content knowledge in three subjects through an integrated approach. Given the innovative nature of this course, three instructors conducted a self study over three semesters to answer the following question: how does this course impact pre-service teachers' perspective of collaborative teaching? In addition, this study documented how three instructors worked together during the course and reported their findings about the benefits and challenges of such collaboration.

Literature Review

Collaborative teaching happens when two or more educators take responsibility for planning, teaching, and monitoring the success of learners in a class. Each instructor contributes to the class based on his or her experience and expertise. Particularly, since many new programs/courses emerge out of more than one traditional discipline, faculty members find it necessary to combine their expertise in order to address the needs of these courses or programs (Kulynch, 1998). Collaborative teaching can also happen when faculty work together planning several classes as "cluster courses" (Dugan & Letterman, 2008). In this case, the clustered courses share the same large issues or one course serves as a base for another course. For example, Potterfield and Majerus (2008) described the collaboration between a physiology class and a statistical class. Real data such as heart rate, blood pressure, and lung volume collected by the physiology students were provided to the statistical class. Two classes shared their investigation through multiple formats including a course website, large group discussion, and final presentations.

Although collaborative teaching can happen within one course or between courses, the literature often focuses on the one-course case. Such collaboration can take place in different formats. Vogler and Long (2003) summarize various types of collaboration including: 1) faculty from diverse

departments teaching an interdisciplinary course, 2) faculty from the same department teaching different sections of the same course by individually rotating section to section, repeating lectures in their areas of expertise, 3) team members presenting together in all sections of the course. Helms, Alvis, and Willis (2005) describe three team teaching styles: the interactive model, the participant-observer model, and the rotational model. In the interactive approach of collaboration, collaborators participate in the lecture or activities together with a great deal of interaction and dialogue between them and their students. The participant-observer model requires collaborators to be present simultaneously in the class, but with one independently teaching while the other observes (the collaborators alternate the teacher and observer roles). The observing faculty interacts only when asked questions. Under the rotational model, collaborators teach separately and attend class only when teaching their specific areas of the course. This model involves less interaction between collaborators and less integration of course materials.

Recent studies of collaboration in teaching have suggested that collaborative work is beneficial to both students and instructors. For students, collaborative teaching can foster their interest and enthusiasm (Hinton & Downing, 1998; Letterman & Dugan, 2004), improve their achievements (Johnson, Johnson, & Smith, 2000), enhance their team work abilities (Kapp, 2009), and promote their interdisciplinary learning (Davis, 1995; Letterman & Dugan, 2004; Wilson & Martin, 1998). For instructors, collaborative teaching provides them with opportunities to be engaged in more philosophical discussions and to learn from each other's experiences and teaching styles (Davis, 1995; Letterman & Dugan, 2004; Robinson & Schaible, 1995). Particularly, collaborative teaching is beneficial for both students and instructors when it promotes diversity by including teaching members from different disciplinary areas in addition to different ethnic and cultural backgrounds (Hinton & Downing, 1998).

In teacher education, collaboration between the education faculty and k-12 schools is gaining popularity and is even mandatory in many places. The idea of schools as teaching practice clinics has been adopted by a number of teacher education institutions. School teachers are invited into teacher education classrooms as guest speakers or collaborative teachers. Education faculty members go to schools to supervise student teaching, teach courses at the school site (Sluss & Minner, 1999; Surbeck, 1994), and/or provide mentorship to classroom teachers (Justiz, 1997). Studies of these collaborations have documented improvement in the development of pre-service teachers' knowledge and skills, the relationship between schools and universities, and the mutual support and respect between faculty and classroom teachers (Freeman, 1993).

Another popular type of collaboration in teacher education is between general education faculty and special education faculty (Murawski & Swanson, 2001). Given the increasing diversity in American schools in terms of learning ability, social-economic status, ethnicity, and culture, education

faculty members have found that it is hard to be effective when delivering teacher education in isolation. Teacher educators who came from different disciplines and differ in cultural backgrounds and research expertise need to teach together in order to prepare pre-service teachers for inclusive instruction. Kluth and Straut (2003) report a collaborative case of this type including two instructors, one from special education and the other from general education. In two college courses, they co-taught most of the sessions modeling different types of co-teaching such as parallel teaching, station teaching, and one teach/one assist models. In parallel teaching structure, they split the large class into equal sections and chose one of two following options. They either provided each group with the same lesson or activity carried out simultaneously by the two faculty members or they individually taught different topics to a group of students and then switched the student groups and repeated the lesson. In station teaching structure, they divided instructional content into segments and presented the content concurrently at separate locations within the classroom. In the one teach/one assist model of collaboration, one served as the main instructor, and the other acted as an assistant who facilitated group work or provided assistance to individual students in the class.

The collaboration reported in this paper represents a different rationale for collaboration, namely integrated curriculum among traditional subjects such as science, math, and music. Curriculum integration was proposed in a contrast to the conventional school subjects that were designed to parallel major academic disciplines of mathematics, science, arts, philosophy, and humanities. One of the most cited reasons for curriculum integration is the disconnection between a discipline-based curriculum and the real world. Cumming (1994) claimed that this disconnection between a disciplinary curriculum and the real world causes students to think school education is irrelevant to their life experience. Another argument for curriculum integration comes from a unified view of knowledge. More than thirty five years ago, Hirst (1974) suggested that an integrated curriculum could be justified through a holistic view of knowledge, which looks at knowledge as connected, embodied, ecological, and harmonized. Employing this view of knowledge, Perkins (1991) criticized individual school disciplines as artificial partitions with historical roots of limited contemporary significance. A third angle that integration supporters take is to look at the way students learn. The disciplinary curriculum is based on the assumption that students will get a holistic picture of knowledge after they learn its parts. This mechanical and analytical point of view has been criticized by scholars who believe that individuals construct knowledge holistically, based upon their life experiences (Bredekamp, 1987; Mid-Continent Regional Educational Laboratory, 1993).

In the last two decades of the 20th century, a number of national science and mathematics educational associations such as the American Association for the Advancement of Science (1998), National Research Council (1996), National Council of Teachers of Mathematics (2000), and National Science

Teachers Association (1997), began recommending the use of integrated curriculum as a tool for education reform. Integrated curriculum has since become increasingly popular in the field of education (Berlin & Lee, 2005). As a result of this movement, few of today's educators would argue against the need for an integrated curriculum. However, for many teachers the implementation of curriculum integration is still not an easy job. They are simply not prepared for it. Most teachers took disciplinary curricula at post-secondary institutions where subjects were taught separately. They had no opportunity to think of the connectedness between disciplines. Particularly, the methods courses they took from teacher education programs were often arranged by subjects. They received little training to teach subjects in an integrated way. Therefore, although elementary teachers usually teach multiple subjects and have the convenience to integrate them in teaching, they fail to take the opportunity. In order to prepare pre-service teachers to teach an integrated curriculum in elementary schools, the three authors with backgrounds in science, math, and music respectively, collaborated in teaching an integrated methods course. To our knowledge, there is limited research in the literature regarding this type of collaboration, which makes our study unique and significant.

Course Design and Description

The course was a multidisciplinary methods course designed to equip pre-service teachers with knowledge and skills that are essential for integrated instruction of math, science, and music in elementary schools. It involved field teaching experience as well as university classes. For the first five weeks of the course, the whole class met at the university three times a week: Tuesday morning and afternoon (two sessions) and Thursday morning (one session). Each session lasted three hours and focused on one of these three subjects. Beginning in the sixth week of the course, the class was randomly divided into three groups. Each group met twice a week led by one of the three instructors. On Thursdays, the instructor facilitates his or her group at the university to prepare a lesson in his or her specialized subject area. The lesson topics were pre-determined and published in the syllabus. The pre-service teachers were required to think of the topic ahead of time so that they came to the Thursday class with their own draft lesson plans or ideas for teaching this topic. A final agreed-upon lesson plan was developed through the class discussion.

On the following Tuesday, the group went to their assigned schools to teach their prepared lesson and spent the rest of day observing classroom teachers. Each participant from the same group taught concurrently a group of pupils at a large area, such as the student lunch hall. The assigned instructor of this group observed their teaching practice every time. Immediately following the observation, while still on the school site, the instructor debriefed the group about their teaching. This pattern of Thursday prep and Tuesday execution was continued in three week segments, rotating

for each of the three subjects so that each pre-service teacher taught three lessons for each subject.

As described above, this course involved field teaching experience as well as university classes. While a combination of university courses and field experiences is common in teacher education programs, our integration of field experience with university classes in a single methods course is quite innovative. In the practice of teacher education, university methods course instructors and pre-service teachers' faculty advisors for their teaching practicum are often different people. This has the potential to create inconsistencies between what is taught in university courses and what is advised in school teaching practice. This concern, however, did not exist for our collaborative methods course. The three instructors helped the pre-service teachers prepare the lessons, and then observed how they implemented these lessons in the school classrooms. This arrangement allowed the instructors to examine whether pre-service teachers understood and appropriately applied what they learned in their coursework. It also provided instructors with the opportunity to modify their university lessons for pre-service teachers' needs.

Research Design and Data Collection

Participants came from the university's Science, Letter and Society program, specially designed for undergraduate students who aimed to become elementary teachers. The program engaged university students, mostly females, in a balanced curriculum between academic disciplines including science, arts, social studies, and humanities before they registered for pedagogy courses. This study was conducted over three sequential semesters in the Department of Education. All pre-service teachers enrolled in the pedagogical course described above participated in the study. In the first semester, the class size was 25 with one male. In the second semester, the class had 22 pre-service teachers, all females. The third semester had the largest enrollment, 47, with two males.

This study had an explorative nature and therefore employed a qualitative research design (Creswell, 2008). Reflective journals, field notes, and meeting minutes were the data source. In the first semester, student participants were asked to write reflective journals at the beginning of the course, after each lesson, and at the end of semester. To reduce the course workload, participants in the second and third semesters were asked to write only initial and exit reflections at the beginning and end of the course, respectively. In their initial reflective journals, participants were asked to respond to several questions regarding their knowledge competency in each subject, the skills they had to teach each subject, where they had developed the knowledge and skills, their interest in each subject, confidence in teaching it, and initial perspectives of collaborative teaching and curriculum integration. In their after-lesson reflections and particularly exit reflections, participants were asked to write what they had learned from the course in

terms of subject knowledge, skills to teach each subject, and confidence to teach it, as well as any changes they experienced regarding their perspectives of collaborative teaching.

For the instructors, brief minutes were taken for their meetings at various stages of this course to record the discussed issues, emerging ideas, and agreed-upon decisions of each meeting. Each instructor also noted down his or her experience when observing collaborators' teaching. In addition, at the end of each semester, the three instructors reflected on their collaboration. A few questions were used to guide the scope of their reflections including what they learned about each other's subjects and their collaboration.

A content analysis approach was employed to analyze the pre-service teachers' reflective journals (Berg, 2009). We first used open coding to annotate each participant's journals with regard to the topics described above. Then, we focused on the segments that report participants' experiences and perspectives of collaborative teaching. The following themes were identified: participants' learning experiences with this collaborative course and the reported changes in their perspectives of collaborative teaching. Instructors' meeting minutes, observation notes, and reflective journals were analyzed through a similar approach, with a focus on their learning through the study. Data coding was cross-reviewed by two researchers.

Findings and Discussion

Working Together for the Benefit of Instructors and Students

At the university where this study took place, elementary teacher education program designs methods courses in an integrated format due to the limited number of program credits and the concern of curriculum integration. It offers two methods courses to cover subject pedagogy: Social Studies, Art, and Language Arts in Elementary Education (6 credits) and Mathematics, Science, and Music in Elementary Education (6 credits). The later course had been offered to pre-service teachers for over ten years before this study took place, however it was primarily taught as three separate methods courses with little connection addressed between the subjects. When the three authors took over the course, they decided to make it more of an interdisciplinary course. They met several times during the university break to prepare and discuss the course before the first semester of this study.

During this initial planning, one comprehensive syllabus was developed to replace the three separate syllabi used in the past. The syllabus clearly described the nature of collaboration and integration of the course, and created a common, parallel curriculum sequences and assignments for the three subjects. The assignment guidelines were also included in the syllabus so that the pre-service teachers could follow the directions no matter which group they were in. The schedule for the different groups was listed in

a table format. The three instructors decided to use the Blackboard learning management system as a convenient communication tool. The course outline and assignment requirements were posted on Blackboard. Pre-service teachers could electronically upload all of their assignments, which included lesson plans, observational papers, and reflective journals. The use of Blackboard was also beneficial to the instructors because, through its online grading system, they could easily allocate the grading workload. More importantly, the three instructors made an effort to identify connections or overlaps between the subjects and coordinate their curriculum sequence accordingly.

In addition to the collaboration in the course planning, the three instructors met regularly throughout the semester on Thursdays after the university class, particularly during the first semester of this study, to discuss the course progress. Additionally, when there was a need to discuss emergent course-related issues, conferencing was conducted face-to-face and via email for the purpose of idea sharing and decision making. Most meetings took place at the lunch hour in their offices, lunch room, or restaurants in a format of formal/informal dialogues. By having lunch together, they gained the opportunity to get to know each other through informal conversation and shared thoughts that might have not come up during formal meetings. Meeting and eating together built a close personal relationship among the instructors and provided them with excellent opportunities to share teaching ideas and get to know each other's teaching, subjects, personality, and family and cultural background. For example, during one lunch meeting, the music instructor and math instructor shared their understanding of the connection between musical notes and the concept of fraction in math. The results of the discussion were implemented in the following music session to facilitate students' understanding of musical notes such as half, quarter, or eighth note symbols.

To better enhance collaboration, the three instructors observed each other's sessions at least twice in one semester and recorded brief observation notes and reflections. The observer could join in the class discussion as well or even act as a discussion leader when the topics were relevant to his or her subject. For example, when the music instructor observed the science session on pendulum, she was called on by the science instructor to link the pendulum with the musical instrument "metronome" and demonstrate the integration between science and music. As she held the pendulum at different lengths (resulting in different frequencies of swing), pre-service teachers were asked to sing a common children's song along with her in a pace that matched the frequency of the pendulum.

Peer observations made the three instructors familiar with each other's teaching styles and instructional emphases, and more important, they often resulted in new ideas about integration between sessions and subjects. For example, while the math instructor was observing, the science instructor discussed constructivism in one morning session on inquiry-based learning.

During the math session in the afternoon of the same Tuesday, the math instructor referred to what pre-service teachers had learned from the science session about constructivism and used it to set up the theoretical platform for her math instruction. Another example entails the science instructor's observation of a music session. In the middle of the class, the music instructor commented how the different thickness of string would generate sounds with various pitches and the length of string will matter as well. At this moment, the science instructor realized the connections between this comment and what he taught in one science session. He politely joined in the class discussion by questioning pre-service teachers: "Does the thickness of the string influence the frequency of a pendulum?" Scientifically speaking, the pitch was related to vibration and resonation. Different types or sizes of materials will vibrate differently and therefore generate differing sounds. Therefore, the thickness of string does matter in the generation of the sound. However, the scientific model of a pendulum takes the string as an imaginative line. The thickness of the string is not a concern of the scientific description of a pendulum. This episode helped students understand the connections and differences between music and science and become aware of the limitations of science.

To assist the music instructor with pre-service teachers' full understanding of the fact that varying lengths and thickness of a string can generate different sounds, the science instructor took it upon himself to relate the science concepts to the music session. He changed his plan for the next science session in order to teach pre-service teachers scientific understanding of vibration and resonation so that they would understand music concepts better. He believed that in-depth knowledge about vibration and sound would help pre-service teachers make sense of what they were playing in the music sessions.

The benefit of this observation was clear to the science instructor: questions generated from other subjects created moments or topics for his science session to cover. His modification to the pre-planned curriculum was necessary for the generation of a holistic understanding among pre-service teachers about what they learned from different subjects. Constructivists suggest that teachers should let students' learning drive what they teach (Von Glaserfeld, 1995; Zhou, 2010). These constructivist notions were clearly reflected in the science instructor's reaction. To further the collaboration, the science and music instructors discussed the possibility to develop a joint session on vibration, sound, etc. for the coming semester.

Instructors' Reflections on the Collaboration

All three instructors agreed that the collaboration was a process to learn about "working together" as well as "collaborative teaching." They found that they shared very similar teaching philosophy and possessed a constructivist teaching style. Through this collaboration, they were excited to learn that there were many connections between the three subjects. Observation,

reflection, and discussion helped the three instructors gain ideas to connect one subject to another and made it possible for them to teach beyond what was originally planned so that their teaching better met pre-service teachers' needs.

The three instructors' collaboration in this course happened both outside and inside the classroom. Outside the classroom, they met for planning and discussion. Inside the classroom, they taught through two collaboration models described by Kluth and Straut (2003): parallel collaboration model, where each of them taught a session in his or her subject area, and one teach/one assist model, where one of them taught the class and the other one facilitated discussion or group work. They also tried some joint sessions as well. For example, three instructors taught a joint session on integrated curriculum at the beginning of the semester. All three instructors felt that they had the desire and interest to develop more joint sessions, such as measurement (math) and matter property (science), sound (science) and pitch (music), notes (music) and fraction (math), etc. so they can model various collaborations to pre-service teachers.

The science instructor, who was then a new faculty member at the university, reflected his great appreciation of the benefits the collaboration generated for him. At the end of the first semester of this study, he described the collaboration with two experienced faculty members as a process of being mentored:

> As a new faculty member, the complexity of this course was initially overwhelming to me. It involves collaboration between three instructors, connections between three subjects, and combination of university learning and school experience. It took me a while to understand how the rotation works between three subjects and three host schools. Collaboration with two veteran instructors definitely helped me pass the hurdle.

The math and music instructor, who taught this course before, were happy to see the differences this collaboration generated to the course. They appreciated the fresh ideas the science instructor brought into the courses. The music instructor wrote in her reflection:

> I had been articulating my music sessions only in terms of musical knowledge and skills before the collaboration because I was not teaching mathematics nor science sessions. The collaboration made me see the course in a more integrated way. Although I knew that the concepts of musical note symbols could be related to the fraction concept in math, I didn't know how I could relate musical concepts to science. In this sense, the science faculty gave me many great insights.

Pre-service Teachers' Reflections on Collaborative Teaching

Most participants' comments indicated that they had little difficulty getting used to this new format of methods course and applauded the fresh ideas and unique experience this course provided for them. Their positive feedbacks confirmed the feasibility of formatting methods courses in a new way through combining: (a) university classes and school teaching experience and (b)

multiple subjects. The following are two typical comments from participants' final reflective journals:

> Overall, the format of the course was something positively different. Combining the class is a good experience but can also be frustrating. It is hard to focus on one subject when you know you have two other teachers trying to show you different material all in the same week. That was something I had to get used to over the first few weeks of lecture class. I have always enjoyed collaborative work when it comes to teaching lessons. The experience for me was great and it did really help me understand what it is going to be like in a classroom environment.

> EDE 303 is a unique course. It is a course taught by three different faculties and three different subjects in one course. Although EDE 303 separated science, math and music into three different sessions; it integrated them together. While focusing on one subject, another subject was integrated in the lesson. It was amazing how these subjects related. I never realized that all subjects can be related and integrated. I believe integrated curriculum will help students improve their studies.

Pre-service teachers stated that this course prepared them to better teach children. They greatly appreciated the opportunity to work with an instructor in a smaller group while preparing their lessons at the university and be supervised at the school by the same instructor:

> I also like the idea that we have Thursday's class to prepare us for the future lesson. That helped me to make sure that I was ready to teach, and I had all weekend to gather materials and create an original lesson. I feel that all three professors did a good job in teaching their subjects, and teaching us about integrated curriculum.

> This was *the first collaborative course* [our italics] that I have taken at the college and I found it to be useful… It taught me what to teach and how to teach. I thought that taking the three different subjects as well as going to three different schools was good because now at the end of this course I feel better informed and that I know more about math, science, and music. I also feel that it gave me the opportunity to work with different age levels and different populations. Through this collaborative course … I do believe that the collaborative course was beneficial...

The course modeled how to work together in teaching. As Kluth and Straut (2003) point out, university teaching, particularly methods courses, has direct influence on pre-service teachers' understanding of teaching. Faculty collaboration in university teaching impacts future teachers' perspectives of collaborative teaching and motivates them to teach collaboratively at schools. Many participants applauded the collaboration during the course as they stated in the following comments:

> EDE 303 did an amazing job in integrating the different subjects. It was very useful and interesting. This course was good because it helped me to better understand integrated curriculum. Although three different professors taught the course, but they all worked together and integrated their lessons. The professors worked very well together in order to help make the course feel like it is being taught by one professor instead of three. The professors followed the same guideline and they made a good team.

> The collaborative work in this course helped me understand how important it is to be able to work together. When working in a school, I must be able to work together with other teachers and staff, this collaborative course helped me collaboratively work with others. I was able to listen to others and share opinions.

Not only did this course demonstrate the connections between subjects to pre-service teachers, but it also modeled the way to integrate them in school teaching. Students' understanding of curriculum integration was enhanced by the end of the course:

> At the beginning of the semester, when we were asked about integrated curriculum, I really didn't understand nor had much information about it. Now I have learned how important integrated curriculum is in our schools. It is important for the teachers to connect the subjects. The students will be able to understand the subjects better.

> This course has helped me better understand integrated curriculum, because each subject ties into one another somehow. There are many mathematical components in music, such as beats and rhythms... Throughout each class, I've heard all three professors mention something about integrated curriculum. I feel that all three teachers have helped me to understand, as well as better prepare me, for integrated curriculum.

Conclusion and Implication

This study indicates that collaborative teaching of an integrated methods course is feasible and beneficial to both instructors and pre-service teachers. Through collaborative teaching, each instructor learned how to teach with partners, gained knowledge beyond the subject he or she normally teaches, and was engaged in thinking about his or her own teaching in a broader and innovative way. More significantly, the collaboration was a reciprocal learning process. The three instructors learned from each other's way of teaching and improve their own teaching. For the pre-service teachers, this collaborative course not only helped them understand how three different subjects can be related to each other, but also provided opportunities for them to actually see and experience how collaboration can take place in teaching. Pre-service teachers' understanding of collaboration was enhanced after the course.

Despite many benefits, collaborative work has its own obstacles. The lessons we learned from teaching this integration course are informative to other educators. Collaborative teaching can be time consuming because it requires more meeting time for planning, sharing, and discussion (Davis, 1995). To configure this course, the three instructors took a great amount of time in course preparation, meetings, and observations. Their dedication and desire for the course to be successful was a necessary condition for the success of the collaboration. Given its heavy load, this course carried 6 credits for pre-service teachers who satisfactorily completed it. However, each instructor only got 3 credits for teaching it, which did not reflect the amount of effort they made into the course. The department chair was made aware of this discrepancy and was suggested to find a solution to properly recognize

instructors' workload. Otherwise, the collaborative nature of this course will not sustain.

As Bakken, Clark, and Thompson (1998) stated, collaboration asks for individual member's 'good' personality in working together because there are more possibilities to have adjustment and compromise in decision making. In this study, despite their differences in subject backgrounds and teaching experiences, the three instructors were able to work together. They opened their sessions to collaborators to observe and discuss. Their mutual respect and open-mindedness made it possible for them to analyze each other's teaching and find solutions for effective curriculum integration.

An educator's dedication to student learning is essential for good teaching. However, it alone usually is not enough for collaboration to take place and succeed. Pleasant and fruitful collaboration starts with friendship. The collaborative experiences in this course convinced the three instructors that friendship and trust were a catalyst for successful collaboration. Throughout the course, the three instructors had lunch together once a week and informally discussed their teaching, communities, cultures, and many other topics. This enabled them to build a close relationship and establish trust, thus making them more open to different ideas from their collaborators.

Another important factor for collaborative teaching is a "sense of parity" among faculty members (Bakken, Clark, & Thompson, 1998). It is not easy to have a sense of parity among instructors who have differences in background, schedule, preferable ways of communication, and so forth. The three instructors built their sense of parity through mutual respect and group decision making. All of the course components such as the course outline, assignments, schedules, and policies were derived from their discussions and negotiations. Pritchett (1997) pointed out that communication, involving dialogues, sharing, and negotiation, is crucial for successful team building. Each member needs to beware of what is happening, share the information and ideas she or he has, and listen with an open mind to what others offer. During this course, the three instructors frequently used email communication to keep each other updated. Weekly meetings provided them with a mechanism for sharing ideas, discussing issues, and making collaborative decisions. As a result, none of them felt being left behind or forgotten in the process.

Finally, collaborative teaching can be confusing to students who are used to isolated teaching. At the beginning of each semester, instructors occasionally heard complaints from pre-service teachers. More than one subject in one course, group rotation, and going back and forth between the university and schools were too much for some pre-service teachers' initial understanding of the course. Although a well organized syllabus should be clear enough to address these confusions. However, the instructors found that other solutions needed to be in place to alleviate participants' confusions. In

addition to being available to participating pre-service teachers during office hours, the three instructors used the discussion and announcement tools provided in the Blackboard learning management system for timely communication between the instructors and pre-service teachers.

Although scholars have argued that collaborative teaching promises great benefits for students, Dugan and Letterman (2008) claimed that little systematic research exists to show how such benefits occur. In their survey-based research, Dugan and Letterman analyzed and compared student appraisals of team-taught classes to a norm of traditional, solo-instructed courses. Results indicated that there were no real differences in student attitudes toward team-taught and traditional classes. This report reminds us of the necessity of future research. Our study used the instructors' and pre-service teachers' narratives as evidence to support the type of collaboration we carried in the course. Future research may consider to use other methods such as interviews to verify or confirm the value of such a type of collaboration and generate deeper understanding of how this collaboration contribute to pre-service teachers' learning.

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George Zhou is an Associate Professor in the Faculty of Educatoin at the University of Windsor, Canada. He teaches science methods and graduate courses in science education. His current research interests include discourse in science education, curriculum integration, technology and teacher education, and multicultural and international education.

Jinyoung Kim is an Associate Professor in the Department of Education at the College of Staten Island/The City University of New York. She has taught the multidisciplinary course for many years with specialty in music education. She has published many articles and books about music integration in early childhood and elementary education.

Judit Kerekes is an Assistant Professor in the Department of Education at the College of Staten Island/The City University of New York. She has taught the multidisciplinary course for many years with specialty in mathematics education.

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Experiencing technology integration in education: children's perceptions

Ahmet BAYTAK*

Harran University, Turkey

Bülent TARMAN

Selçuk University, Turkey

Cemalettin AYAS

Sinop University, Turkey

Abstract

The purpose of this phenomenological study was to explore the experiences of six children using technologies in their education. Data were collected via in-depth interviews, classroom observations, and home observations. The results showed that students have common perceptions toward their experience with technology integration. Furthermore, the following four themes emerged; the value of technology, authority over learning, misuses and misconceptions, and the border of integration.

Keywords: children's technology use, technology integration, technology integration at home, perceptions of children, learning and technology

Introduction

Students in today's schools are lucky enough to have access to many technology equipments and the Internet technologies. Almost every house has a computer available to children. According to the 2003 US census 69.9% of households had computer at home and 61.8% of them had the Internet access. For example, based on an unofficial survey done in research site school, 98% of the middle school students had computer at home and almost all of them had access to the Internet. The less developed countries have been also receiving aids to improve usage of technology in their schools. UNESCO and NGOs (Non-Governmental Organizations) are providing funds to such less developed countries in order to provide more technology equipments in their

* Correspondence: Ahmet BAYTAK, Ph.D., Harran University, Department of Computer Engineering, Osmanbey Campus, P.K. 153, 63000-Şanlıurfa / Turkey. E-mail: abaytak@harran.edu.tr Phone: +90 (0) 414-318-3000 (Ext. 1088)

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schools. One Laptop Per Child (OLPC, 2008), for instance, is one of the projects that tries to provide portable computers to schoolchildren in these less developed countries.

As a result of this development, a 'digital divide' or disparity tends to exist between generations. Prensky's classification; digital natives and digital immigrants (2001), is a useful distinction in most communities. While digital natives have been born with new technologies, digital immigrants are still considering these technologies as luxury, extra, difficult, or troublemaker. This difference in generation, thus, brings new issues for use of technology in classroom (Tarman, 2009).

Technology is becoming more and more a part of classroom instruction and teachers are encouraged to use technology for their lessons (Ayas, 2006; Beers et al., 2000; Yücel et al., 2010). Technology in education has the potential for improving teaching and learning. If the current technology is appropriately designed for instruction, Earle (2002) believes, there is the potential to produce positive outcomes, social interactions, changes in teaching styles, more effective teaching, increased student motivation, and enhanced student learning. Speaker (2004) reports that most students feel their learning are improved by integrating technology into their learning. Therefore, educational technologies, specifically computer and the Internet technologies, have inevitably become powerful in the classroom as they change the way we teach and learn (Ayas, 2006). As technology makes learning more interesting, enjoyable and interactive, kids today love learning by doing, discovering, and interacting.

Review of Literature

While most of the technology integration research focuses on integration in classrooms, some scholars have specifically examined children's use of technology at home. Mumtaz (2001) found that children spend more time with technologies at home than at school. However, Lauman's study (2000) showed that students felt more comfortable using computers at school. Kafai and Sutton (1999) found that children's use of computers at home depends on permission from parents who have concerns about their children wasting time on the Internet and not doing educational activities (Mumtaz, 2001). However, it was also found that parents' support on the use of technology affects the level of integration at home (Giacquinta et al., 1993). They also found that few children who integrate technology for learning had highly involved parents who helped choose appropriate software, coached their child on the computers, worked jointly with the child at the keyboard, and offered praise as well as practical.

Even though most studies reviewed mainly focused on technology integration at school and home, students' experiences with technology at school and at home have been rarely investigated. The history of the last decade is also evidence that technological tools are changing dramatically and

therefore technology integration in classroom essentially changes as well (Yücel et al., 2010).

Student perception is an area in which a great deal of research has been conducted. For example, understanding their perceptions of parent involvement, professors' self-presentation styles, and discussion-driven classrooms has been studied in different studies. Research on students' perception of technology in education has been sparse and mostly limited to technology in e-learning or college students' perceptions. Among those studies, Lim et al. (2006) examined students' perceptions on computer vs. pen based testing, McMahn et al. (1999) studied college students' perceptions about barriers with computers, El-Tigi, Lewis, and MacEntee (1997) explored elementary school students' perception on the effectiveness of visuals on web-based instructions, and Shell et al. (2005) examined high school students perception on computer supported classrooms. The study by Levin and Barry (1997) also showed that young students found computers as a game machine both at home and at school.

According to the study done by İşman et al. (2004), students in undergraduate and graduate school perceived computers as a part of their life. These students also had a positive attitude towards computers since they think they are efficient tools for their life. Thus, the researchers concluded that the students had a consciousness about effects and importance of computers. Lui and his colleagues (2006) concluded from their students' perception on blogs that integration of blogs in the lessons could promote educational perception even though there are still some misuses of these technologies. According to Student Perception Model by O'Malley and McCraw (1999), the perceived effectiveness of a technology is based three factors; the prior educational conditions, characteristics of students, and perceived characteristics of technology.

Differently, some scholars explored and examined children's views and preferences about technology materials (Druin, 1999; Druin, 2002; Nesset & Large, 2004). Druin proposed Cooperative Inquiry and Human-Computer Interaction Community to examine technology tools that are proper for children. In these studies, children were involved in design and testing processes to find out their preferences. The User-Design Approach by Nesset and Large (2004) also looked at children's use of technological tools to design proper tools for their levels. However, in this approach involvement was found limited. Even though these approaches are crucial to understand children's views about technology and their use, children's views about integration of technology into education is not studied. Additionally, studies done in Constructionism and design-based research have involved children to explore their learning with technology tools (Harel & Papert, 1991; Kafai, 2005) but these studies are lack of children's perceptions about the characteristics of technologies they used and how those could improve their learning.

The Purpose of the Study

The main goal of this study is to explore how children define and use technology in their education. In other words, this study attempts to observe the experiences of individuals in order to understand their perceptions of technology integration into their education.

This study aims to begin fill the gap in several ways. First, the last decade is evidence that technologies are changing dramatically and therefore technology integration in the classroom must necessarily change as well. Thus, it is important to get a sense of how students feel about recent technologies and the integration of them into learning lives as a whole. Second, past studies primarily focused on upper level students in middle and high schools, thus the concentration here on elementary level students is an important contribution. Third, the increased usage of technology in schools indicates a need for studies such as ours. Finally, there is also an increased usage of technologies at home, which is rarely studied in relationship to technology integration into learning.

Moreover, children's future technology perception and imagination make this study unique. In another words, what kinds of new tools or programs students perceive for future and how these new developments can be used for learning also raise the importance of this study. By looking at students' perception for future technological developments may help technology designers to build more appropriate technological tools for students to use for education.

Research Context and Methodology

The research site was an elementary and middle school located in a college town in the Northeast of the United States. Students attending this school are generally from the middle class whose parents are mostly affiliated with a well-known state university. According to mission of the school, technology is one of the key aspects of the curriculum. The school offers technological equipments for classes and after-school technology clubs. The participants of this study were selected from these technology clubs. The selection of the participants was based on their parents' consents.

In Technology Education classes during the regular school hours, the students were taught about Word processing, Excel, and PowerPoint. In the technology clubs, however, the students designed games and animations with the provided software. Since the study was limited to students in the technology club, the interested students for the study were already good at technology use. For example, out of six study participants, three of them (John, Geff, and Allan) attended statewide conference workshop to display their animation designs.

This phenomenological study attempts to understand and attain a description from the students regarding the perception of individuals and lived experience of individuals about this phenomenon. The discipline

investigates the *why* and *how* of decision making, not just *what*, *where*, *when*. Creswell (1998) also defines qualitative research as "an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting" (p. 15).

In this study, we questioned the experiences of the students with technology integration. We did not expect any change in students' outcome or achievement. The study is neither has any hypotheses to prove. The current study is expanding the research in the participants' lives where they experience technology integration yet it is not based on 'standards' or 'certain objectives' as Marshall & Rossman (1980) puts it. Furthermore, the study is concerned with the process and the meaning of technology integration for the students. Thus, qualitative approach fits perfectly to apply in this research. This study aims to investigate not the external truths but their interpretations of emotions and events within the definition of phenomenology.

Data Collection and Analysis

The data of this study are students' thoughts, ideas and perceptions from digitally recorded interviews, observations in their natural environment, and field notes. Interviews are centered on getting in depth information of lived experience with the phenomena. For a broader perspective, there are two types of observations in this study; classroom observations and home observations. These both observations aimed to get more in depth understanding of phenomenon by recording non-verbal behaviors and physical settings.

Classroom observation was done before and after the interviews. The first observations were helpful to generate some interview questions. Since the researcher had been working with the students before, students were familiar to the researcher's class visits during their technology usage hours. Therefore, it was believed that observations did not influence students' behaviors. Class observations were done by note taking while home observations included recordings in addition to note taking.

Different from previous studies, students' technology use and technology settings were observed at home as well. Home observations were done after getting detail information from the students during the interviews. These observations were limited to 30 minutes and students were also asked some questions to get more information about the technology integration at home.

In depth interviews was necessary for this phenomenological study to get more information about the experience of the students with technology integration. Since the younger students were not that much talkative, we could not follow every step of Irving Seidman's (1998) interview protocol. For example, the interviews were less than 30 minutes each since the students

didn't have anything to say. However, we asked prompt questions based on students statements. That helped us gather clarification and amplification in their thoughts and ideas. Interviews were also recorded with digital voice recorder and there were note taking for prompt questions and outline of the data. After the interviews, the recordings were transcribed with minutes.

An ethical issue that may come up in this study is about the researcher's position at the research place. The students and their parents were informed that there was no grading for students' progress for participating into the study or leaving the study in the middle. There was also no intervention in this study to affect students' behavior or performance at school.

Findings

Background Information

According to mission of the school, technology is accepted as one of the key aspects of the curriculum and the school promises to provide cutting edge technology in its unique educational program. Each classroom is equipped with LCD TVs connected to cable TV service, projectors, internal sound systems, classroom laptops, and cameras available for teacher and student use. The laptop- student ratio was 4:7 and laptops were found more flexible for students to take the classrooms and integrate into any subject area.

The participants of this study were six boys (John, Geff, Tony, Allan, Joe, and Brian- all names presented are pseudonyms) at fifth and sixth grades. Joe was the one of the best in his sixth grade class for academic achievement. John's both parents are teachers and he speaks two languages. He was always interested in topics about computers. He had his own computer at home. Geff could be the quietest students in his classroom but he was always doing his homework and class work on time. His both parents are professors in different majors. According to our home observation there are 4 computers at his house and most of them are available to him.

Even though Tony moved to the country in last few years, he didn't have any problem with language. However, he still needed to improve his self-confidence that was also showed up in the interviews and class observations. Tony was also interested in computers and he attended Technology Club last four semesters. He was sharing a computer with his siblings. Allan also attended all technology clubs sessions in last two years. His classmates called Allan computer geek. He had already used several computer programs with his own computer at home. His parents are involved with university.

Joe and Brian were also attended all technology club sessions but both were less interested in computers games comparing with other four students mentioned above. Joe also had his own computer at home and was able to fix most of the problems with his computer. Brian was sharing one computer with his siblings and limited time to access this computer during weekdays because of his parents' views.

Children's Perceptions

Based on the data analysis, four themes emerged; the value of technology, authority over learning, misuses and misconceptions, and the border of integration.

The value of technology: Almost all the students had similar perceptions when defining technology. All of them believed that anything that works with electricity is technological. Allan, however, added "controllable tools" to his definition as he thinks these tools must be helpful also in order to consider them as technological. John thinks that technological should "entertain." When they were asked for examples, they started with computers and game boys. On the other hand, none of the student has ever heard of the term "technology integration." But, they were aware of the influence of technology in their learning.

When the students were asked about their first experience with technology, most of them recalled their first game boys and what they learned from these tools. All the students think that their first experience with technology was fun and now they still feel fun when they use for even educational purposes. For example, John mentioned that "… [for] example like writing essays writing, instead of your hand for writing you can type and I think typing is fun and less tired. Doesn't tire you that much."

Authority over learning: Class observations and interviews transcripts are evidence that students feel an authority over their learning in classroom with computers. It was observed that students' behaviors in technology based classes, comparing in their other classes, altered from followers to semi-follower. In other words, students were acting as they were fully dependent to teachers but in classes with computers they were more independent. Similarly, students perceived that they cognitively feel ore powerful when they use computers in their lessons. For instances, as other five students, John mentioned in the interview that:

> "I think technology make me feel smarter because of all these lots of parts put together so how can I explain well (…example?) like going on internet seeing like math reading all these kinds of stuff, finding out new links to easy ways, they make so much easier and make smarter. I do better that way."

Misuses and misperceptions: Since integration of technology especially with computer technology is new topic in most school communities, there are still some misuses ands misperceptions by teachers and parents who have has hold the main power for the decision on integration.

Even though the students' technology experience at school considered as integration, the use at home is not common. Similar to a previous study (Kafai & Sutton, 1999), this study also found that the parents' concerns, limitations, and less experience with integration becomes a barrier for the

integration at home. The home observation and interview also projects parents concerns since the students used computer at home mainly for gaming and chatting. However, Brian pointed out "I just try to use that time (his has 30 minutes every day to use for anything) to do my homework, not after I do my homework I can others (he listed others as games etc.)."

It was observed that only few teachers use technology tools in their classrooms and therefore students had less integration experiences in other classes. The students believe that technology can only be integrated in certain subject areas. For examples, Tony preferred use technology in math class but not either in science or physical education classes. Similar to that Brian also think that music should not be taught with computers.

The border of integration: When the students were asked about advantages and disadvantages of using technology for learning, they built a border of technology in education. For example, most of the students listed "searching on the internet" as one of the main benefits of technology for education. Similar to other findings (Saye, 1997) in the literature, students in the current study apparently valued the efficiency, speed, and clarity that technology provides for education. Allan specifically focused on how that Internet based communication could help economy based on his mother's experience. He, indeed, thinks that animated content on computers also get attention and therefore implementing computers for learning will be not as boring as reading book.

Nevertheless, some students think that use of technology in learning should be limited. For example, Brian and Geff prefer to have a person teach them instead of learning with computers since machines may not give them instant feedback. Allan thinks that "*it is funny to use term 'educational' for the cartoons on TVs since they are not*." All the students have fear that the computers may get broken and they lost their files. This fear was experienced during the researcher's class observation that some younger students delete a student's file for his social studies work. It can be driven from the interview and observation that students think that technical problems and viruses, less feedback functionality, and physical damage on eyes are the common barriers to integrate technology into education. Because of those listed benefits and barriers, students have drawn an imaginary border of technology in education. It was found that students, such as Allan, with more experiences in technology use, had a wider border when they described advantages and disadvantages of technology in education.

Based on the students' radius of the border they had drawn, their views of technology integration for future were shaped. When we asked them what kind of technologies would be in classrooms in next ten years, John expected that there would be holograms, better quality microscopes, and machines that type for users. Besides his dreams of teleports in future, he also noted that "… we can use to study like other recourses such as machines that will pick up recourses and study it and give a description of it or even maybe our

own kind of microchip. We can and explore with to more field trips to places. Learn more about fossils in a technological way." Another student, Geff, was wishing a common problem in technology integration to be solved without being aware of some programs; "…maybe if you loose a file you could get back."

Discussions and Conclusion

The aim of this study was to explore the experiences of six young students using technologies in their classroom. As a discussion topic of this paper, there are some conclusion could be drawn from the findings of this current phenomenological study.

First of all, it was found interesting that when the students were asked to define the term 'technology', most of them listed the features of technology that has value of fun and entertainment. In other words, the educational value that the children gave to technology was more about the motivational factors. Another value that the students listed for technology was the feature of a tool that makes things easier. Especially, when the students mentioned about communication tools as technology, they emphasized that these tools make their life easier and therefore the process of learning becomes effortless.

Secondly, whether in student-centered or teacher-centered classrooms, students in this study were acted more independent when they were observed in their classroom with computers. Even though the students have ownership of learning and they have more authority over their learning, at these age levels, teachers are still the authority that believed to know everything. The students, for example, think certain website trustworthy because the teacher said so. In other words, students are aware of fact that they need scaffolding in their learning process where the teachers could act as milestone when they needed.

Thirdly, as it has been indicated in the previous studies (Kafai, 2005; Lauman, 2000; Mumtaz, 2001) that children like to use home computers for gaming purposes came up in this study as well. The high percentage of computer use for gaming (77% of children regularly used computers for gaming), has a factors on parents misconception about the use of computers at home. It was found in this study that most of the parents think that their children were not doing anything educational on the computers. A parallel misconception was found among the students' teachers that technology is tool to transfer information, and therefore, they think that home computers are still not under their control to give educational task for students to do. Similar to previous studies (Kafai & Sutton, 1999), this study also found that parent concerns and limited experience with the use of technology for learning could be a barrier for integration at home. For example, Brian pointed out, "I just try to use that time [he has 30 minutes every day to use for anything] to do my homework, after I do my homework I can do others [he listed others as computer games etc]." Thus, there is a need for schools and

teachers to rearrange the types of homework, which may require more technology use such as doing more research, designing digital artifacts, or building their own portfolios. In addition, it is necessary to setup more communication channels between teachers and parents to increase effectiveness of home technologies for educational purposes. Course management systems are available options to start this communication.

Finally, this study revealed that students draw the border for the integration of technology into education. Even though all the children of this study see technological tools as fun and entertainment channel, they were mostly conscious about the balance of technology integration into their lessons. The children were able to list the advantages and disadvantages of this integration. However, it was found that, the students' less experiences of the integration in both classroom and at home had influenced their perceptions. Supporting to this idea, İşman et al. (2004) pointed out in their study that "this means that there is a consciousness about effects and importance of computers but there are a few tendencies to apply the consciousness or willingness of new technological style because of not having particular education, encouragement and facilitative environment" (p. 20).

In addition, it was discussed in the previous studies that teachers and K-12 schools and faculties in higher education complained about technical problems and lack of support (McMahon et al., 1999). However students in this study mentioned those as teachers' problems. The reason for that could be because they do not see the technical problems as their responsibility or they found their ways overcome to problem. For example, based on classroom observation and interviews, students try to solve technical problems by themselves. It could also be concluded that the more implementation, the wider the border of integration could be.

In conclusion, this research disclosed the reality that changes in technology influence students' experience with technology. Thus, this study should be helpful for the curriculum and technology designers, and educators to consider these perceptions of the students in the future educational plans and policies. Our participants' experiences with technology integration also support Smith's findings that some faculty may not be well prepared or trained for the available technology and which creates distance between students and teachers. Parallel to that, a participant of this current study, Allan, also made a recommendation that "more people should use [technology in classrooms] but they have to have backup plans if there might be virus etc."

Thus, as an implementation of this study, schools may setup their own course management systems to enrich students' learning both at school and at home. For more encouragement of technology integration at home, teachers need to provide more educational games that they should be able to control the content of the games, which becomes both educational and fun for children. Based on the previous studies about teachers' perceptions and the

results of this study, it is also important to note that school administrations and teachers should develop new ways to integrate technology into education for an effective learning environment.

It is noteworthy that children of the Internet generation enjoy communicating through online and sharing the things they liked. Thus, age-appropriate chat and discussion platforms and information and artifact sharing sites are necessary for these students to productively use technology both at school and at home. At the same time students could be required to build their learning portfolios in secure sites manageable by school administrations and accessible to their parents.

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Ahmet BAYTAK is an Assistant Professor in the Department of Computer Engineering at Harran University, Turkey. He received his Ph.D. degree in Educational Technology from The Pennsylvania State University. His major research interests include instructional technologies and the use of computer and the Internet applications in educational settings.

Bülent TARMAN is an Assistant Professor in the Department of Social Studies Education and serves as the vice chair for the Institute of Educational Sciences at Selcuk University, Turkey. He has a Ph.D. degree in Social Studies & Comparative Education from The Penn State University. His research and teaching focused on teacher preparation in social studies, democracy education, and European Union & educational systems.

Cemalettin AYAS is an Assistant Professor of Social Studies Education at Sinop University, Turkey. He received his Ph.D. degree in Social Studies & Global Education from The Ohio State University. His current research and teaching mainly focus on social studies & geography education, teacher preparation, and educational technology.

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